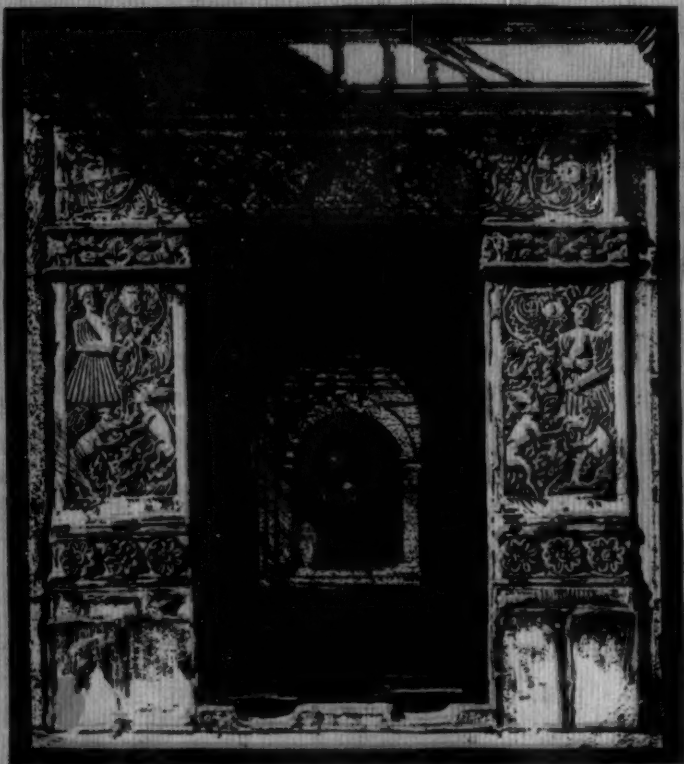
THE ARCHITECTURAL FORUM

IN TWO PARTS



PART ONE
ARCHITECTURAL DESIGN

NOVEMBER

1928

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PART ONE—ARCHITECTURAL DESIGN

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Published Monthly by

ROGERS & MANSON COMPANY

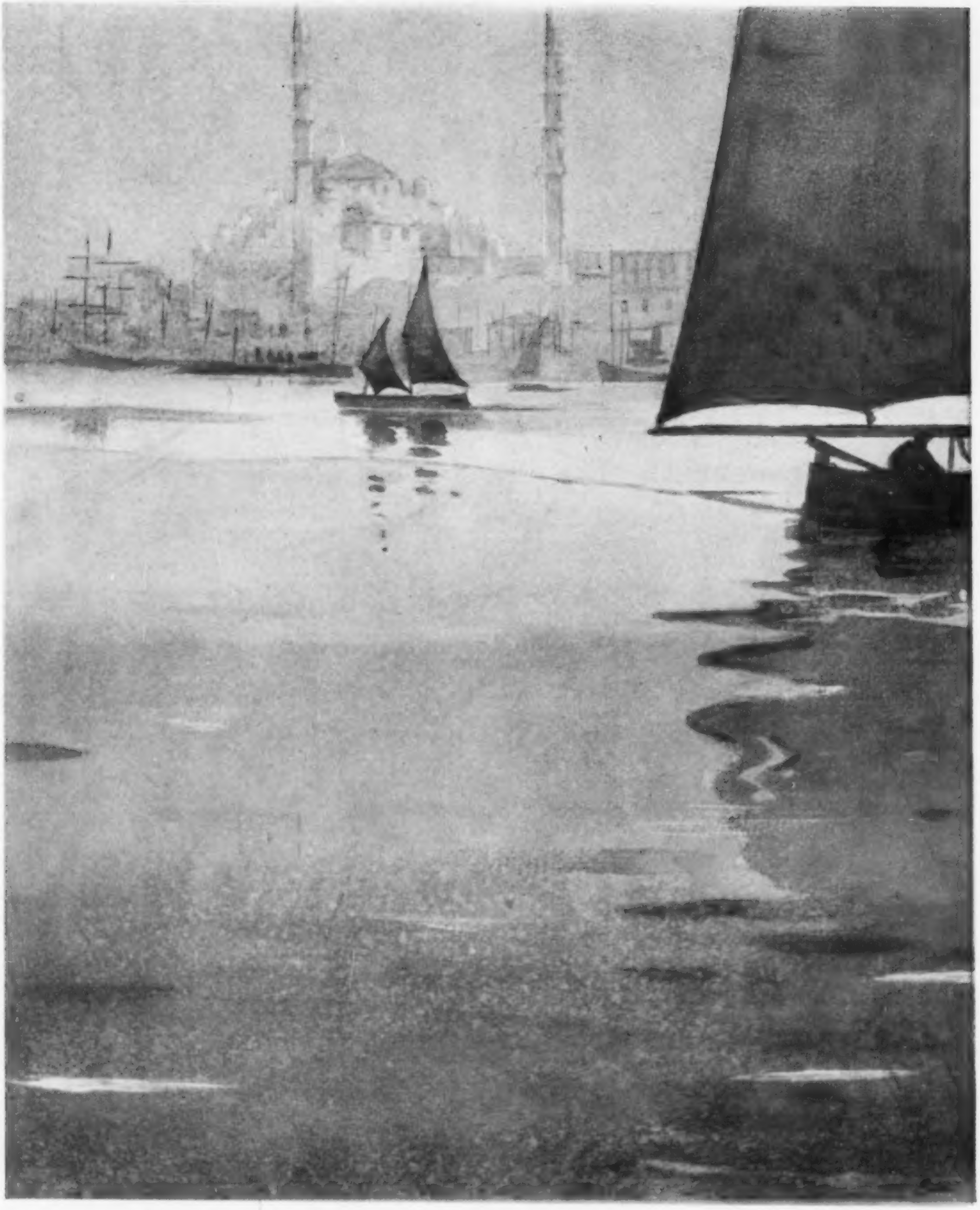
383 Madison Avenue, New York

Howard Myers, Pres.; James A. Rice, Vice-Pres.; Paul W. Hayes, Vice-Pres.; Robert Sweet, Sec. and Treas.

Yearly Subscription, Payable in Advance, U. S. A., Insular Possessions and Cuba, $7.00. Canada, $8.00. Foreign Countries in the Postal Union, $9.00

Single Copies: Quarterly Reference Numbers, $3.00; Regular Issues, $1.00. All Copies Mailed Flat

Trade Supplied by American News Company and its Branches. Entered as Second Class Matter at the Post Office at New York, N. Y.



CONSTANTINOPLE FROM THE BOSPHORUS

From a Water Color by Edward James Matthews

VOLUME XLIX

THE ARCHITECTURAL FORUM

NUMBER FIVE

NOVEMBER 1928

CONSTANTINOPLE

TEXT AND SKETCHES BY
EDWARD JAMES MATTHEWS

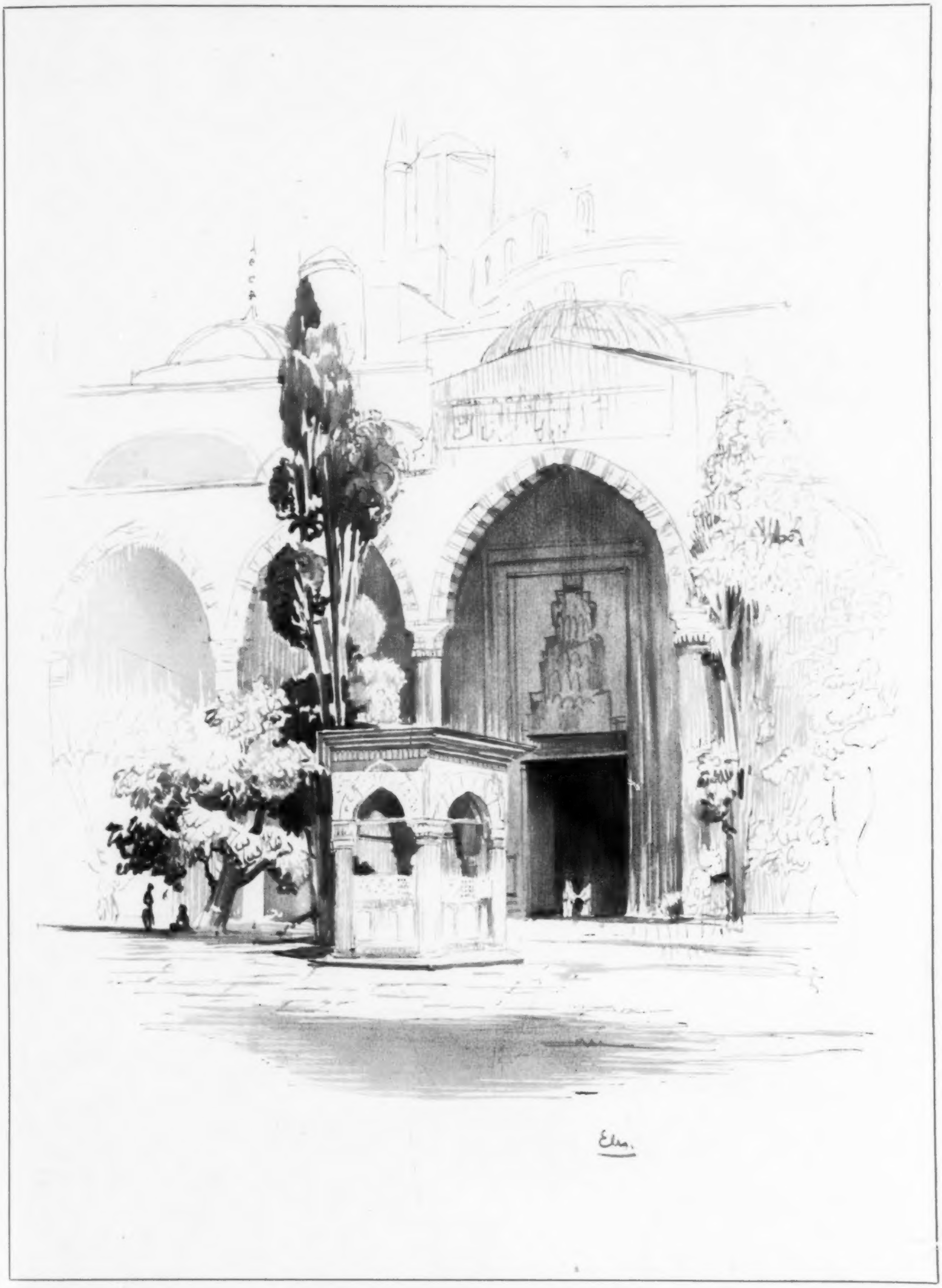
GEOFFREY of Villehardouin, one of the army of Crusaders who in 1204 captured the city of Constantinople, thus described the descent of the Frankish and Venetian vessels on the city: "Then might you have seen the straits of St. George as it were in flower with ships and galleys sailing upwards, and the beauty thereof was a great marvel to behold. . . . Now you must know that those who had never before seen Constantinople looked upon it very earnestly, for they never thought there could be in all the world so rich a city; and they marked the high walls about, and the rich palaces and mighty churches,—of which there were so many that no one would have believed it who had not seen it with his own eyes;—and the height and the length of that city, which above all others was sovereign."

More than seven hundred years later, in 1922, the crusading baron's description remained singularly applicable, and never, perhaps, even in the days of the later Empire, had Constantinople been filled with more widely divergent racial elements than on the brilliant August morning when we came down the Bosphorus from the Black Sea. In place of the Venetian and Genoese trading vessels that would have lain in the same roadstead in the middle ages, of the Frankish and Italian galleys, and the long ships that brought the members of the imperial bodyguard from their native Scandinavia, there were liners, rusty tramps, Greek barquentines, and the battleships of four nations. Huge British men of war lay like thunderclouds under the domed skyline. French and Italian cruisers swung anchored in columns along the Bosphorus, while American destroyers clustered against the shore, black ribbons of smoke rising vertically from their funnels. The inter-allied occupation of the straits was well established, and brisk trade was already under way.

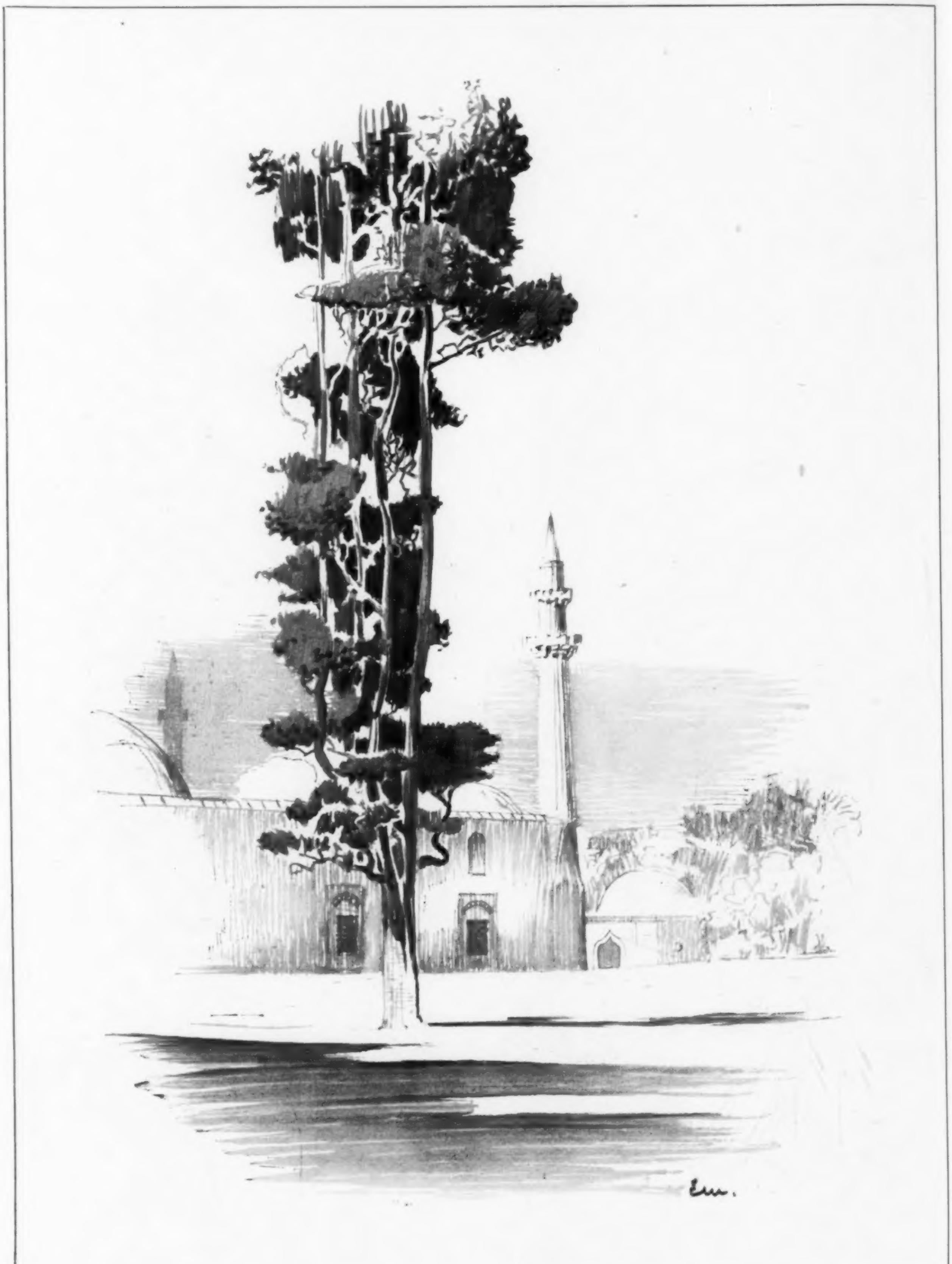
In the city's streets the descendants of Venetian and Genoese traders, Frankish crusaders and English mercenaries were supplemented by Australians, black troops of both France and England, Arabs, Highlanders, little yellow Annamites, American "gobs" and an endless procession of other nationalities. Besides these there was the mixed population of Turks, Levantines, Greeks, Jews, Armenians, Persians, and blacks, each with a distinguishing dress or uniform. But of all the peoples that thronged the streets, the Russians seemed most numerous. Cossack officers of Wrangel's forces and soldiers of Denikin's defeated army were everywhere, gleaning somehow a sustenance from the crowded city. Their varied uniforms lent further variety to the kaleidoscope of the Grande Rue de Pera. Beautiful Russian girls strolled down the boulevards on the arms of smart British, French or Italian officers, or acted as hostesses and entertainers in the cabarets. "Maxim's," the famous night club run by the colored ex-valet of an American ambassador to Russia, was just beginning its career, and its dusky proprietor was giving employment to his former patrons in the capacities of doormen, hat check girls and hostesses. The city was again the focal point of eastern Europe, after five centuries of Turkish domination. Life in Constantinople at that time was fascinating, and made the study of architecture difficult. . . .

On the farther shore of the harbor from Pera, the European colony, Stamboul, lies on seven hills, a jumble of massed houses and white domes, stretching indefinitely to the westward. The clouds that hurry down the Golden Horn cast thin veils of shadow along the hills. Mosques that are momentarily in silhouette, gleam white against the sky when the shadow passes, while the brilliant cadmium and black of the shipping make a foil for the soft colors of the town above. At sunrise a rose colored mist envelops the city, pierced by the gold of the highest minarets and domes, and the city seems to fulfill one's most sanguine expectations; but a sad disillusionment is in store for the traveler who looks more closely, seeking the color of an Oriental town, and a feeling of disappointment is the usual reaction of the architect in the streets of Stamboul. Coming, as most do, from the lovely irregularities of Italian hill towns or of Carcassonne, or from the more sophisticated architecture of Rome, Paris or Florence, there seems to be little at close sight to recommend this sprawling city of frame dwellings. The costumes are picturesque and colorful,—or were in pre-Kemal days,—and the rather saccharine charm of dome and minaret remains a testimony to the accuracy of our cigarette advertisements; but of architectural beauty, little is to be seen. The vision of a white Oriental

THE MOSQUE OF AHMED
From a Pencil Sketch by Edward James Matthews



COURTYARD OF A MOSQUE
From a Pencil Sketch by Edward James Matthews



THE TERRACE OF SULEIMAN
From a Pencil Sketch by Edward James Matthews

THE KAHRIE DJAMI
From a Pencil Sketch by Edward James Matthews

CONSTANTINOPLE FROM THE LAND WALLS
From a Pencil Sketch by Edward James Matthews

city, serene above a cobalt Golden Horn, is not realized, nor is any expectation of immediately visible Byzantine or classic survivals. Constantinople is neither Oriental nor Occidental, and it lacks the essential picturesqueness of the one without approaching the ordered reasonableness of the other. Its quality is unique and lies so much within the sphere of intellectual rather than that of purely æsthetic appreciation, that discussion of it has small place here. It lies in a kind of arid beauty,—in a sadness of decay, of which one is conscious only in the more remote quarters of the old town or in solitary walks outside the "Land Walls." Here, miles from the bustle of the Galata Bridge and the bazaars, it is especially to be sensed. The old Byzantine fortifications are nearly intact, their tops overgrown with weeds and showing occasional gaps where the stones forming the crenelations have fallen. To the westward from the battlements, the undulating plain, sere and yellow in the dry windless heat, stretches along the Golden Horn to Eyoub. Its mournful expanse is dotted to the horizon with irregularly spaced shafts marking Turkish graves. Dusty, ancient cypresses stand among the tombstones. On the east the roofs of the city start abruptly at the foot of the walls, and, diminishing in the distance, interspersed with the broken and roofless minarets of abandoned mosques, rise gradually to a culmination in the great mass of the Suleimanic mosque. A haze of heat usually subdues the piled dwellings to uniform grays and brown, broken by the harsh yellow of barren, stony ground. The predominating note is one of dilapidation and squalor, impressive only because of its magnitude. A sultry quiet invests the city; a cry from below or the distant clamor of the busy harbor only serves to emphasize the oppressive stillness. Nothing is wholly intact. Bits of wall, broken minarets, dilapidated lattices conspire in creating a sense of hopelessness. Nothing is uniform, nothing rectilinear; the irregularity is so universal as to create an effect of monotony. Yet this unredeemed drabness, having none of the conventional patina that sometimes lends beauty to decay, fails in being wholly hideous. It has a quality of impressiveness,—almost of beauty,—the perception of which is contingent upon a realization of the magnificence of the past, for the surviving monuments of Byzantium are submerged beneath constantly changing masses of frame and stucco buildings. These are pieced together from the remains of previous survivals of fire, siege and decay,—an accumulation that has continued from the early middle ages and has gradually eliminated most vestiges of the Roman city. Historically, Stamboul is filled with associations. The form of the ancient Hippodrome is still traced by streets.

The great cisterns built by Constantine and Justinian still exist, and the passage by boat through their echoing colonnades, with a lantern faintly illuminating the dripping shafts of the columns and the black water, is an extraordinary experience. The Serpent Column from Delphi, the obelisk erected by Theodosius, the *Colonne Brulee* and the Tower of Galata, built by the Genoese, are all survivals of a history filled with traces of widely differing nationalities and of the racial conflicts that were incessant for 14 centuries. One finds in the stony, winding streets occasional bits of wall that consist of single courses of dressed stone, separated by three or four courses of flat Roman bricks or tiles. These usually indicate the sites of ancient structures, but a building externally wholly Byzantine is rare, and the outline of a cupola, a moulded window reveal, or a fragment of vine pattern in a wall is usually the sole indication of the existence of a historic monument. A number of interiors, however, have been preserved. Those accessible are without exception churches, the Byzantine residences having been occupied and adapted by Turkish owners to their own mode of living. But, thanks to the fact that the Mohammedan ritual could be carried out in Christian edifices without radical changes to their plan and structure, a number of religious monuments dating from the sixth to the fifteenth century have been preserved almost unaltered as to their interiors. Had the Turks been nature worshipers or believers in some non-ritualistic faith, we should perhaps have had to depend on Venice and other western cities for our knowledge of Byzantine architecture. It is, then, to the churches that one must go to find the carvings, mosaics, and marbles that with certain structural principles comprise the contribution of Byzantium to architecture.

The most important of these are Sancta Sophia, built in the sixth century under Justinian, and its structural predecessor, Sts. Sergius and Bacchus, on the sea of Marmora. Both have been externally submerged by the efforts of the Turks to preserve them from destruction. The interior of Sancta Sophia is too well known to demand description. Sts. Sergius and Bacchus, however, aside from its mosaics and lovely capitals, is interesting as a structural experiment. It bears in some degree the same relationship to later Byzantine and Turkish buildings that the cathedral at Evreux bears to the full blown Gothic of Amiens and Beauvais. It shows a structural transition from the dome placed upon a circular drum, as in Roman precedent, to the dome brought by means of pendentives to the four corners of a square. In this instance the architect, groping for the principle later used in Sancta Sophia, employed columns placed at the angles of an octagon to support his cupola. The effect is unsatisfactory, necessitating as it does a "fudging" of the arch spandrels to effect the transition to the circular form. This dome is remarkable for its scalloped shape. It resembles a half-melon, the raised sections diminishing toward the apex.

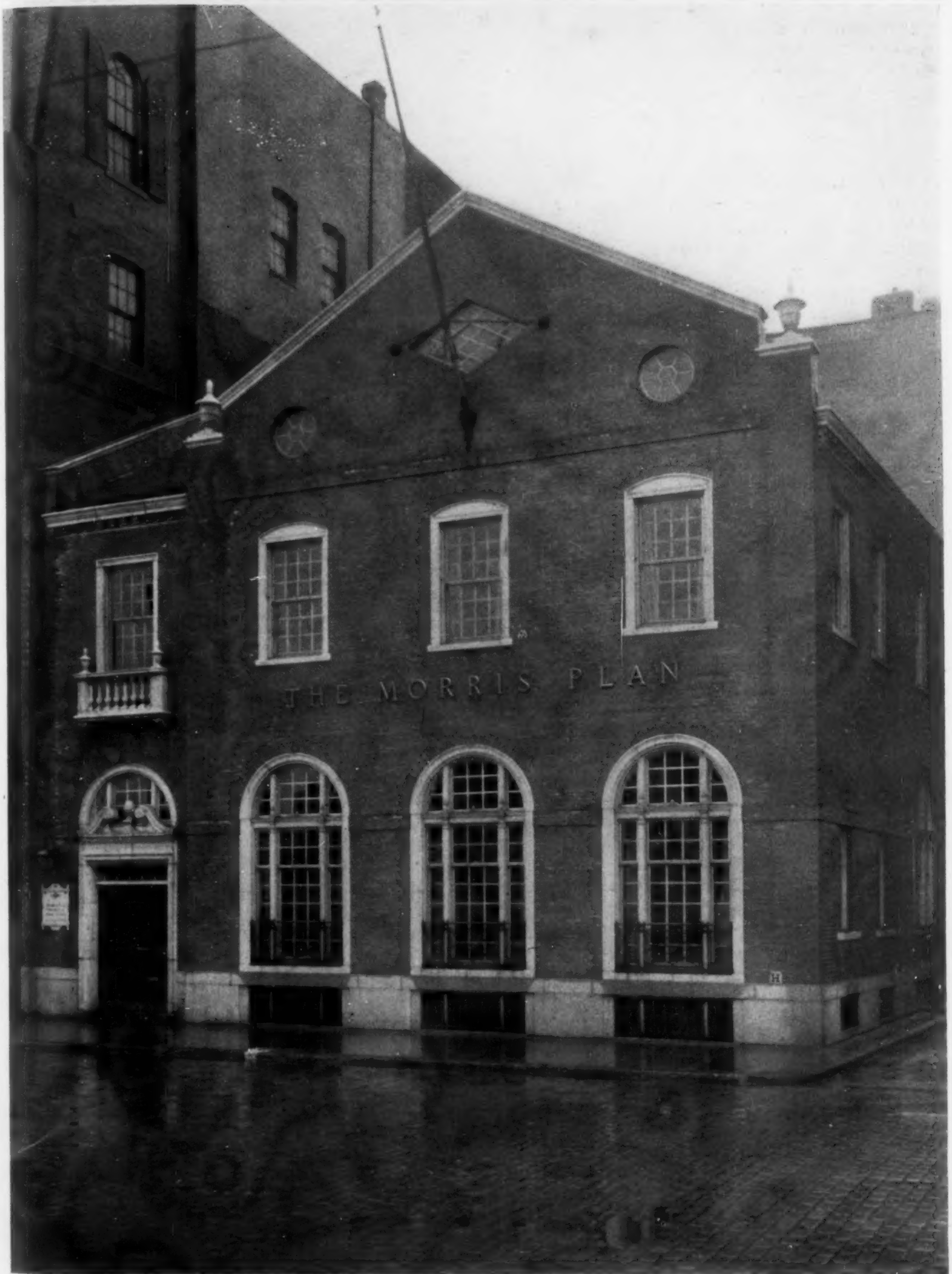
St. Irene, near Sancta Sophia, is one of the few churches which has remained externally Byzantine. It is now a Turkish military museum and is filled with a fearful collection of lethal devices, its walls lined with colossal paintings of Turkish warriors pursuing neatly uniformed unbelievers. The dome of St. Irene is, to my mind, the finest in Stamboul.

A fourth church of interest was at one time the chapel of a Byzantine monastery, just inside the western walls of the city. It is, like the others, now a mosque, the *Kahrie Djami,* and it follows more nearly the conventional form of the Greek Orthodox churches as found in Athens, Saloniki, throughout the Aegean islands, Macedonia and in the Balkans. Its chief interest lies in the mosaics that cover the walls of the triple porch, and which vary in date from the dawn of the Eastern Empire almost up to the time of the Turkish conquest. The vigor and richness of these mosaics are extraordinary. Fortunately, an enlightened administration has rescued them from under layers of whitewash, and they glow with colors unimpaired in the soft reflected light that streams through the open door. I sat and sketched in the narthex of this church while good natured but unwashed Turkish soldiers watched, breathing heavily in my ear, as I attempted to draw.

Several smaller Byzantine churches are scattered about Stamboul. Each has some claim to the attention of students of architecture, but it cannot be denied that on the whole little remains that would indicate the greatness of Constantinople's past. Sancta Sophia, however, is an exception to this statement, and, epitomizing an epoch as truly as the Parthenon or Chartres, it is itself a sufficient reward for the long journey. Mohammed the Second, conqueror of the Eastern Empire in the fifteenth century, is said to have been responsible for the great buttresses that reinforce the dome. At the time of the Turkish conquest the edifice was much older, relatively, than is the Cathedral of Chartres today, and it is not surprising that the piers that had stood the strain of the two successive domes should have shown signs of weakness. St. Paul's in London has already demanded repairs upon several occasions, although built in comparatively recent times by one of the world's ablest engineers. How remarkable, then, is the achievement of Justinian's architects, Isidorus of Miletus and Anthemois of Tralles, who having evolved a structural form contrived in the first building constructed according to the new principle not only to span an enormous space but to build so well that when, 900 years later, the barbarians crushed the Eastern Empire, they found the great church intact!

The Turks brought little with them, but proceeded in their mosques to adopt the structural principle of the pendentive dome, building up to the present day according to the model left them by Isidorus, and there is little that could be characterized as purely Mohammedan architecture in Constantinople. Sancta Sophia's pendentive dome remained a model for all places of worship. The contemporary European styles influenced architecture in nearly all its phases. First Italy then France became dictator of Turkish taste. Painted ornament was introduced as an inadequate substitute for the mosaics of Byzantium. Tile was used largely for the same purpose and is perhaps the most interesting and beautiful factor of the Turkish style. But there is no evidence of any creative impulse. The Turks showed only the capacity to adapt existing forms and inventions to their own use, themselves changing not a little in the process. It was perhaps this latter quality of flexibility, this willingness to accept a useful innovation, that enabled them finally to capture the city. At the time of Mohammed the Second the Turks had already made themselves masters of the use of artillery for purposes of siege, an art that had then made little progress in Europe and of which the Byzantines were ignorant. It was the skilled gunners of the Turks and their ability to employ highly organized troops unencumbered by armor that routed the Byzantines. The great Empire that had withstood the batterings of Oriental hordes for centuries, succumbed on the night of May 29, 1453, when Constantine Palæologus, last of the emperors, rallied the remnants of his troops within the tottering walls of the great Hippodrome for a last hopeless stand. The Sultan Mohammed entered the city over the closely packed corpses of the Christian defenders, and according to legend rode his horse through the portal of Sancta Sophia. Thousands of Christians had taken refuge in the church and were crowded in terror under the great dome, beseeching God to preserve them from the barbarians. The story goes that the Sultan rode up to the high altar, and turning raised his hand as a signal that the massacre might begin. That moment marks the end of the Empire of the East. Sancta Sophia has become one of the greatest of Mohammedan places of pilgrimage. Constantinople, because of its situation, has been and must continue to be an important city. But with the Turkish conquest, the art of Greece that had beautified the Roman city came definitely to an end. Having conquered, the Turks settled down to the enjoyment of their prize, abandoned their nomad existence, and became an urban population that contented itself with gleanings of the artistic products of East and West. Sinan, the head architect or *Mi'mr Bashi,* of Suleiman II who lived in the sixteenth century, is celebrated as much for the versatility of the soldier-artist as for his creations. He is a great exception to the Turkish rule of artistic mediocrity.

One leaves Constantinople with an impression that both Byzantines and Turks, however inferior they may have been in some respects to the artists of Periclean Greece and of Rome, understood two things thoroughly,—the use of color in architecture and the use of small scale ornament for the enrichment of surfaces and architectural details. The oriental influence that appears throughout the city's history gave rise to a type or ornamentation that had far more of the abstract and purely decorative character of Asiatic work than even the European Romanesque, which of course derived from it to a great extent. Now that design is coming into its own again, and the day of "Expressionism" and Victorian symbolism seems to be finally drawing to a close, there is much to be learned in the field of decorative art from the lovely ornament of Byzantium.

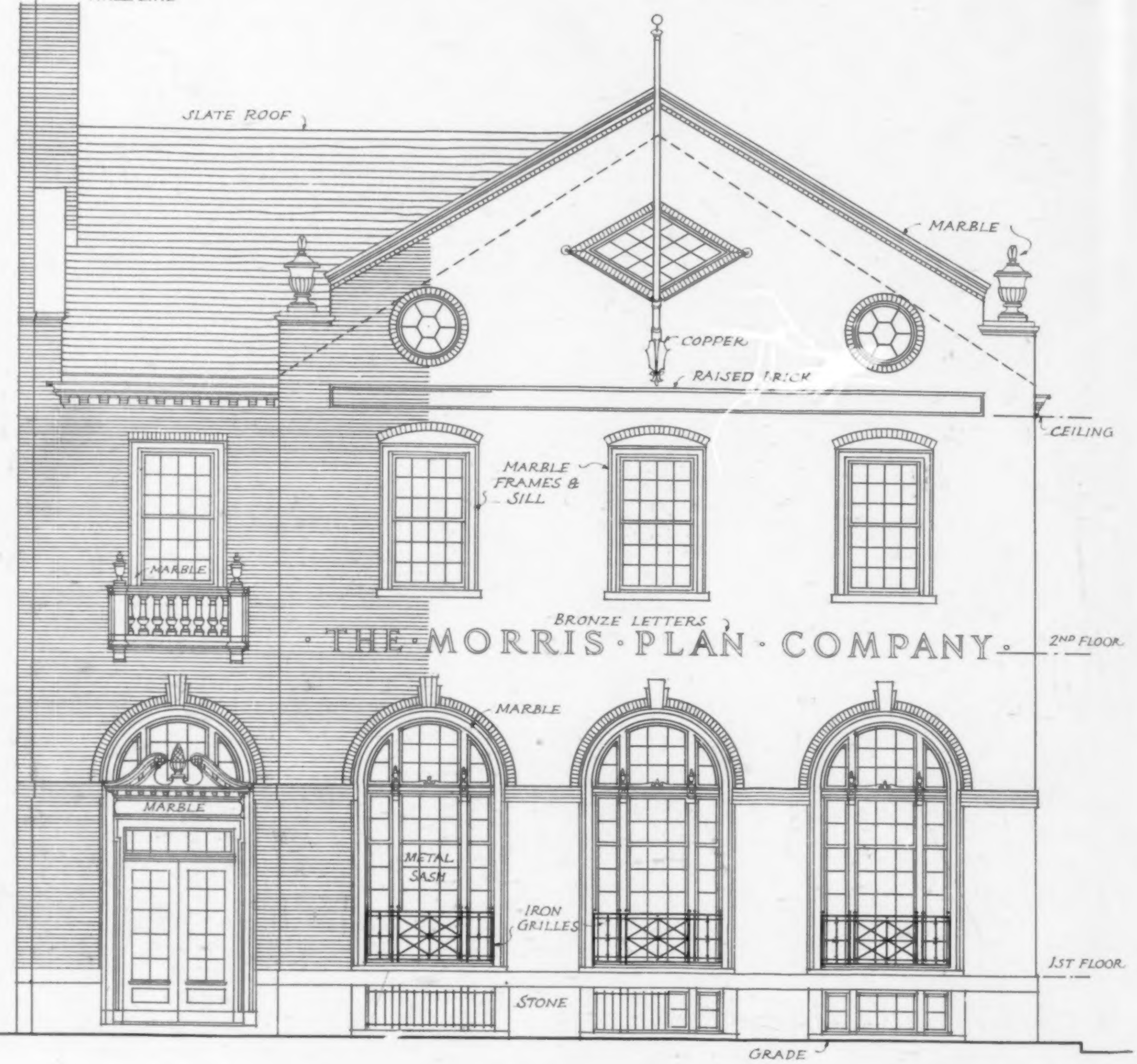


Photos. Frances Benjamin Johnston

Details on Back

MORRIS PLAN BANK, PROVIDENCE

JACKSON, ROBERTSON & ADAMS, ARCHITECTS



FRONT ELEVATION

BUILDING for the MORRIS PLAN COMPANY of RHODE ISLAND
JACKSON ROBERTSON & ADAMS ARCH'TS. PROVIDENCE R.I.

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NOV. 1928

No. 83

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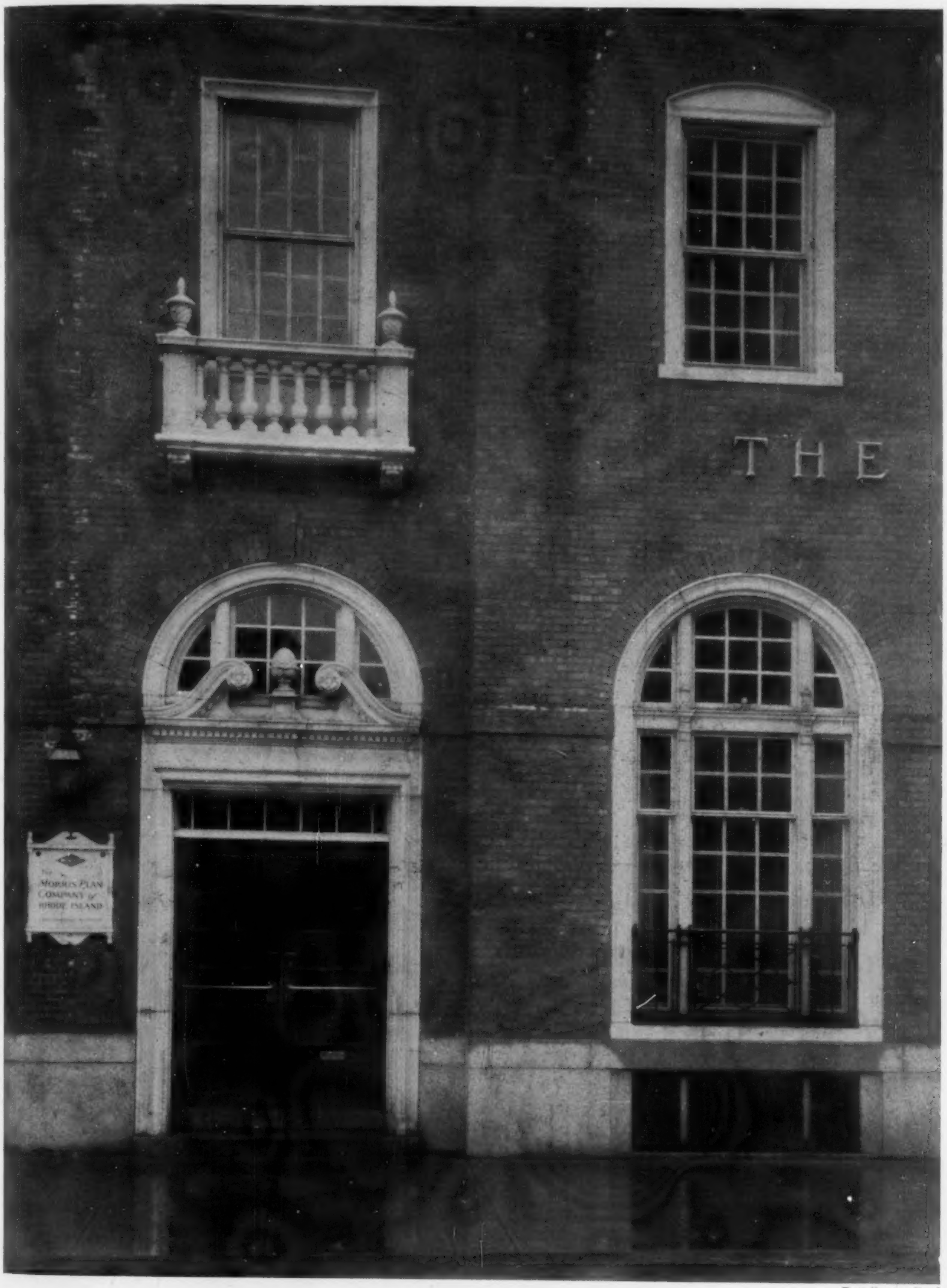

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ENTRANCE, MORRIS PLAN BANK, PROVIDENCE
JACKSON, ROBERTSON & ADAMS, ARCHITECTS

SECTION

PLAN AND ELEVATION

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No. 84

The ARCHITECTURAL FORUM DETAILS

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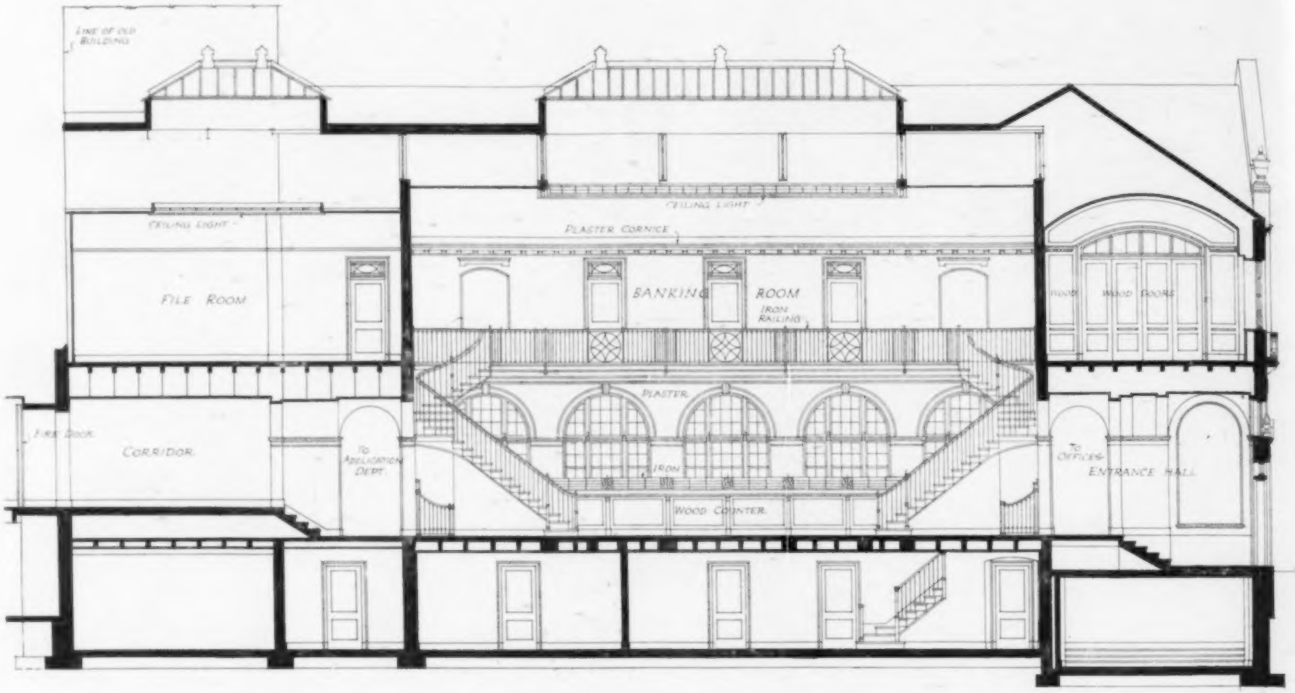
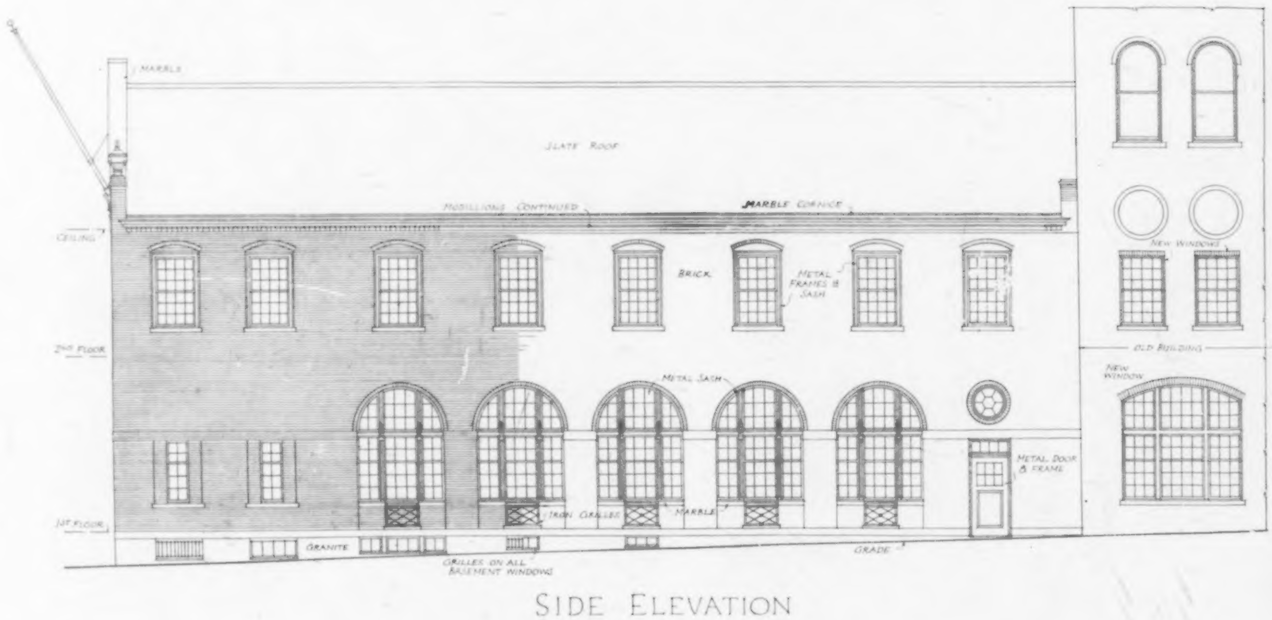
MAIN BANKING ROOM
MORRIS PLAN BANK, PROVIDENCE
JACKSON, ROBERTSON & ADAMS, ARCHITECTS



LONGITUDINAL SECTION



SIDE ELEVATION

BUILDING for the MORRIS PLAN COMPANY of RHODE ISLAND
JACKSON ROBERTSON & ADAMS ARCHTS., PROVIDENCE, RHODE ISLAND

NOV 1928

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SCALE IN FEET

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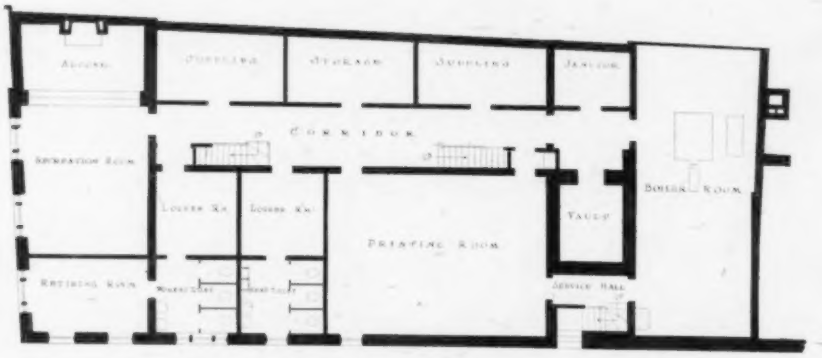
The ARCHITECTURAL FORUM DETAILS

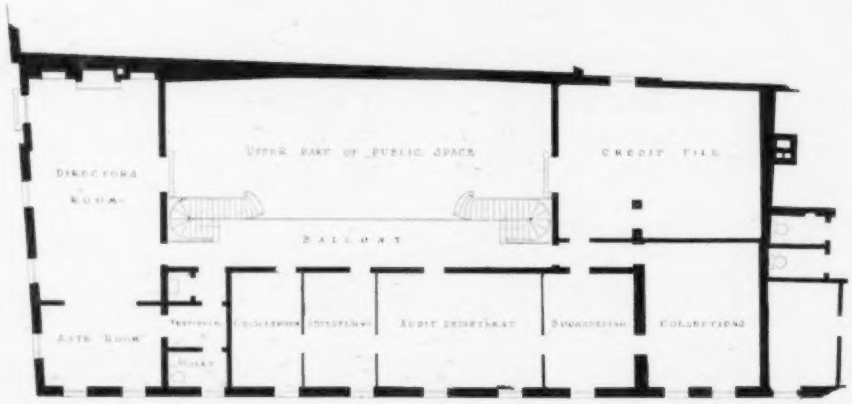
Plans on Back

AN INTERIOR; MORRIS PLAN BANK, PROVIDENCE

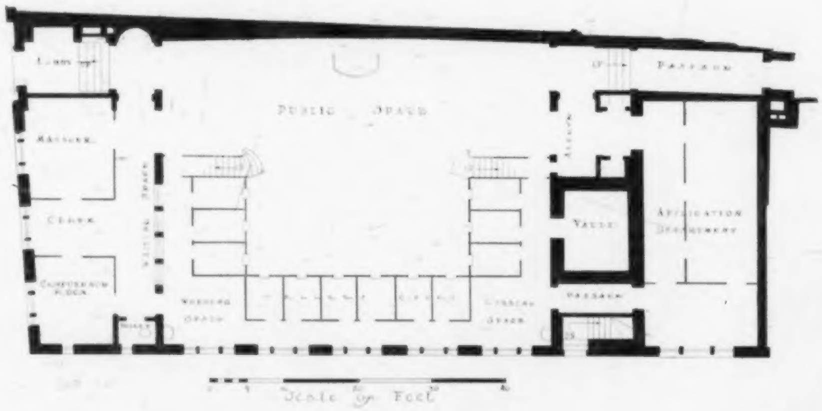
JACKSON, ROBERTSON & ADAMS, ARCHITECTS



THIRD FLOOR



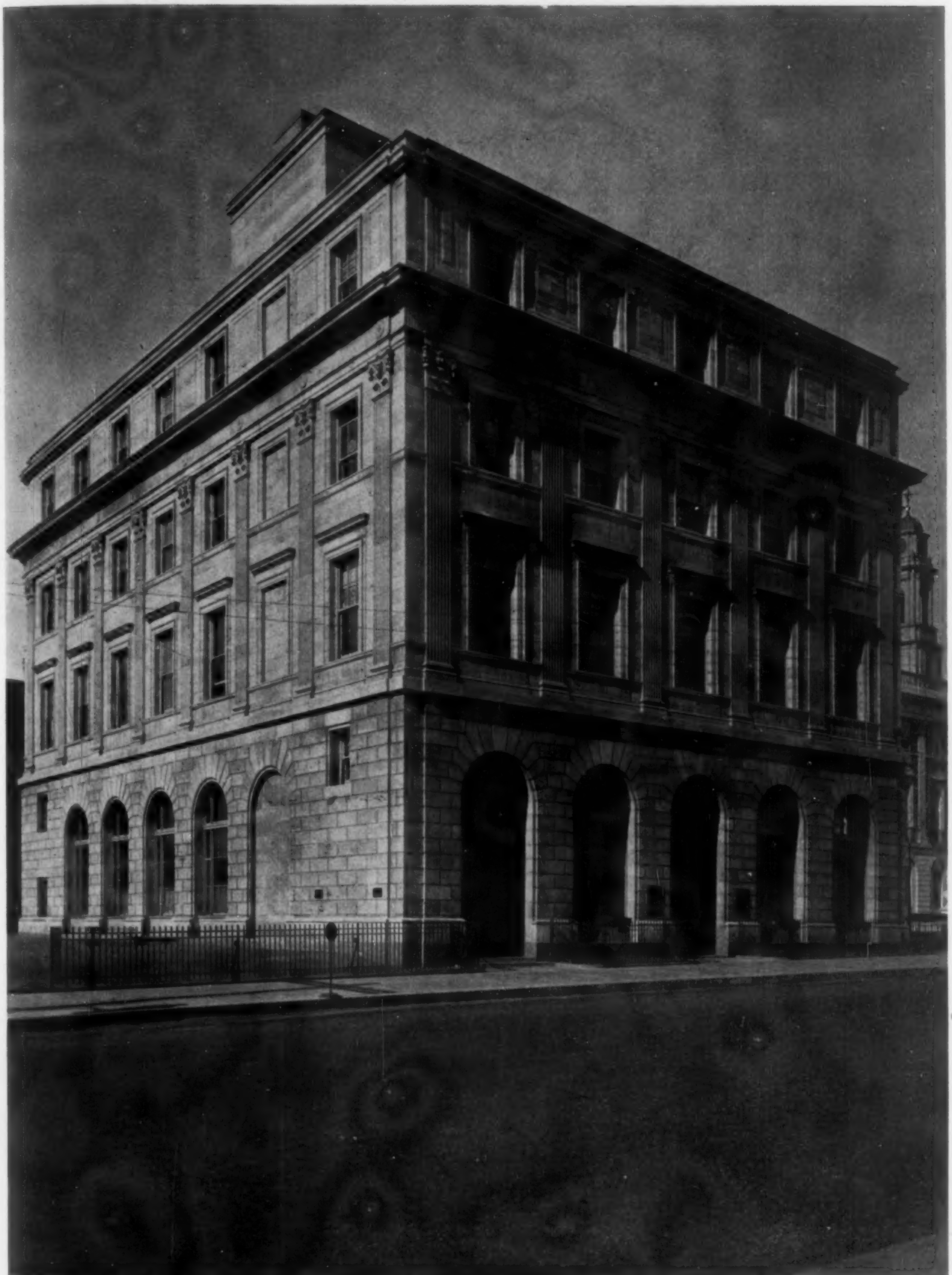
SECOND FLOOR



MAIN FLOOR

PLANS: MORRIS PLAN BANK, PROVIDENCE

JACKSON, ROBERTSON & ADAMS, ARCHITECTS



Photos, John Wallace Gillies, Inc.

WATERBURY NATIONAL BANK, WATERBURY, CONN.
CASS GILBERT, ARCHITECT

BANKING ROOM, WATERBURY NATIONAL BANK, WATERBURY, CONN.
CASS GILBERT, ARCHITECT

Photos. Frances Benjamin Johnston

OLD INN AT WAKEFIELD, R. I.

DETAIL OF END OF HOUSE, SHOWING SHINGLED HOODS OVER FIRST STORY WINDOWS
OLD INN AT WAKEFIELD, R. I.

SOME GREEK REVIVAL DOORWAYS IN OHIO

BY

THOMAS E. O'DONNELL

BETWEEN the years 1800 and 1850, the Greek Revival movement made its appearance, gained momentum, ran its course,—and declined. It was during this period that the "more progressive" builders championed the new style. In certain localities and with a certain class of people it became the vogue, just as today the Spanish style has become a fad. What was then prevalent in the east was also reflected in the middle west, particularly in Ohio, which had always been markedly influenced by eastern tradition. It was during this period that the old Colonial type of doorway, like the house itself, gradually began to conform to the new Greek style. The change did not take place all at once, but came about slowly through a process in which modified Greek forms were used here and there in the design of doorways in place of the old, freely interpreted classical forms of the colonial period.

The transition step from the Colonial to the more developed type of the Greek Revival was through the classical of the Roman variety. The classical details of the colonial period were very free interpretations of the Roman. During the classical revival period, which immediately preceded the Greek Revival, there was a conscious attempt on the part of the designers and builders to go back to and copy, exactly, the old Roman forms. Upon the advent of the Greek Revival, the process was one of substituting the Greek forms for the previously used Roman forms. By the time the Greek Revival was established in Ohio, the builders had, for their assistance, many carpenters' handbooks, such as those by Asher Benjamin. By the aid of these the builders were able to draw and execute Greek elements of architecture with some degree of understanding and accuracy. The Greek Revival doorways in Ohio are not lacking in variety. They range all the way from the very simple enframement to elaborate two-story "frontispiece" effects,—from where the doorway proper is a simply treated opening in a curtain wall, to where its architectural embellishments become so elaborate, extended and semi-detached, that it is difficult to tell, in some instances, whether the architectural features about the doorway belong to it, or to the body of the house. Again, in other types, it is difficult to differentiate between the ornamental decorative features of the doorway and those of the porch or shelter which accompanies it. The simplest of these is of the type represented by the side doorway of the Joseph Swift house (page 652), which once stood near Vermilion, a sketch of which is included here. It consists of a simple enframing of the door opening with battered jambs and simple architrave lintel, joined so as to give the effect of projections or "ears" at each side. The prototype for this is of course the frame of the windows in the Erechtheion, which was known to the builders through the measured drawings published by Stuart and Revett and which had been made available to them through copies in the carpenter handbooks.

A more typical treatment for a small Greek Revival doorway is that of simple pilasters and crowning entablature. Variety was obtained in these by varying the details and proportions, by means of which a surprising number of different designs were obtained. In the simpler types only the door proper was enframed. The next step was to include side lights. In some instances the pilasters were left very plain, while in others ornaments of Greek origin were used, as in the doorway of the old house on Buckeye Street in Wooster (page 650). This particular ornament, the honeysuckle, seems to have been a favorite with the Greek revivalists in Ohio, for it occurs frequently. This pilastered type of doorway was varied in still other ways. The simplest were those in which the pilasters had a very slight projection from the wall, thus giving a flat effect. In some cases a marked projection was given, thus imparting to the doorway a feeling of massiveness, and in others, columns were set in front of the pilasters, carrying a projecting entablature and a flat roof or pediment, thus forming a porch over the doorway. Many examples of this type are to be found in Ohio, especially in the larger town houses.

A characteristic doorway of the Greek Revival period is the recessed type. Here again there is a great variety, ranging from the simple recessed opening to the two-story recessed "frontispieces," features of the larger houses. The simple doorway of an old house in Delaware exhibits an opening filled with a door flanked by two sturdy Greek Doric columns, and supporting a simple lintel. In other and better examples this simple lintel is replaced by a full entabature, set with the architrave and frieze flush with the wall. All three of the Greek orders are found used in doorways of this type. In some of the finer doorways, the door proper is flanked by both columns and pilasters, the pilasters serving as a finish to the edges of the wall openings. In some cases the pilasters were set out at some distance, thus adding depth and massiveness to the doorways. The doors of the Allen (page 650) and the Wilson-King (page 651) houses, Chillicothe, are examples.

Recessed doorways were not invariably of the single-story type. For very large and more elaborate houses, the wall areas above the doorways seemed too heavy and blank for the single openings below. There was a desire to lighten the upper portion, also to give emphasis to the entrance. This was done very effectively by making the recessed portion carry through two stories. A whole series of these are to be seen in certain large towns in

A more elaborate type of recessed doorway, worked out in stone. From the Allen house, Chillicothe, O. Here the entablature is carried upon two columns that are flanked by pilasters, all of which are set flush

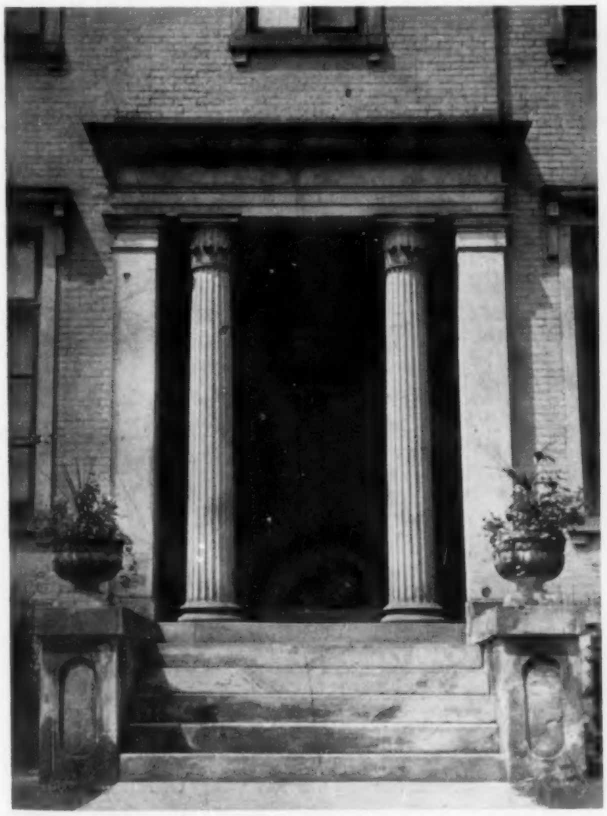
A typical Greek Revival entrance porch in the "Ionic" style. From the Wallace house, Chillicothe, O. The architectural features frame the doorway, as in the pilastered treatment, but project to form a porch

A typical treatment of the simpler Greek Revival doorway, especially those of small frame houses, is exemplified by this doorway from an old house on Buckeye Street, Wooster, O. It consists of flat pilasters and a well defined entablature

A massive type of Greek Revival doorway, found in larger houses, showing more of the real spirit of the period than those often seen. The proportions are those that one would expect to find in stone. From an old residence in Warren, O.

The doorway of the Andrews-Case house, Delaware, O. An example of the very late, over-massive Greek Revival doorway of the two-story type

The doorway of the Atwood house, Chillicothe, is representative of the later two-story type. The lower portion was usually of the same design as the one-story type.

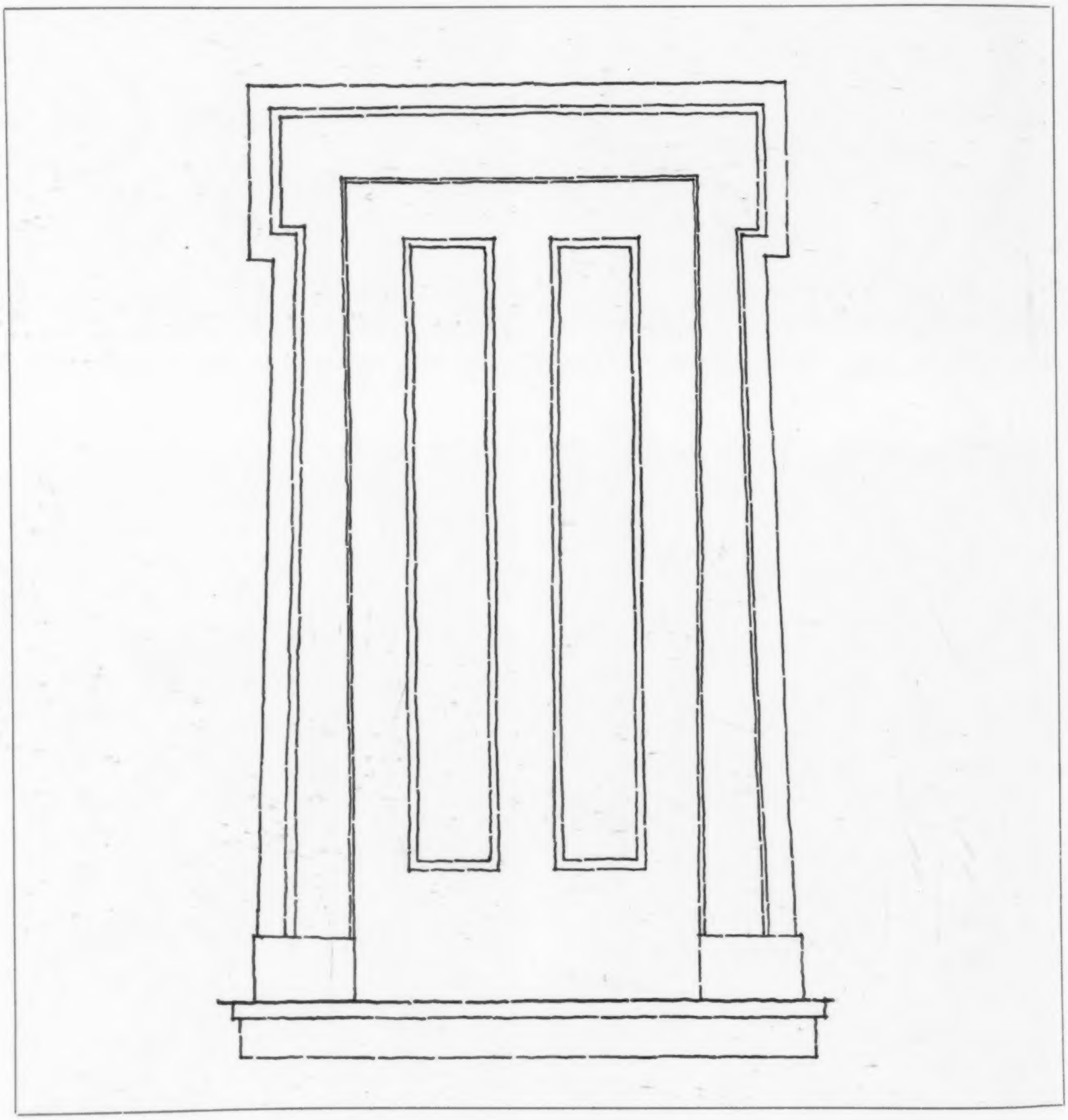


Recessed doorway of the Wilson-King house, in Chillicothe. A larger and more formal type of Greek Revival doorway, built entirely of stone. In this case the whole feature is set slightly forward.

An old doorway in Chillicothe that is typical of the massive Greek Revival recessed doorway. The opening is here embellished by a wooden entablature, which is carried by two wooden columns.

Ohio. In Chillicothe there are some particularly fine examples, such as the old Joseph S. Atwood house (page 651). These are especially graceful and pleasing in design. The Andrews-Case (page 651) house, in Delaware, is typical of the heavy, massive examples, and is lacking in that refinement and delicacy of line which are expected in residential work. In all of these the Greek spirit and the use of certain Greek forms are evident, and the builders are to be commended in that they were not content with imitating Greek buildings, but tried to get at the spirit of Greek work and to adapt the forms to their own necessities. Houses built in this manner were common in Ohio in the 'forties and mark the climax of the Greek Revival movement there.

Although lacking in much of the grace and refinement characteristic of the Colonial, the Greek Revival doorways in Ohio are not without interest and charm. Unlike the Colonial types in Ohio, they passed through a real development, and many new and original designs were worked out. It is because of this great diversity of design that these old Greek Revival doorways offer much in the way of suggestion and inspiration for modern work in the middle west, where they may justly be considered native regional types possessing particular interest.



The Greek Revival doorway in its simplest form as found in the Joseph Swift house, which once stood near Vermilion, O.

ENTRANCE OR MAIN ELEVATION

Photos. George H. Van Anda

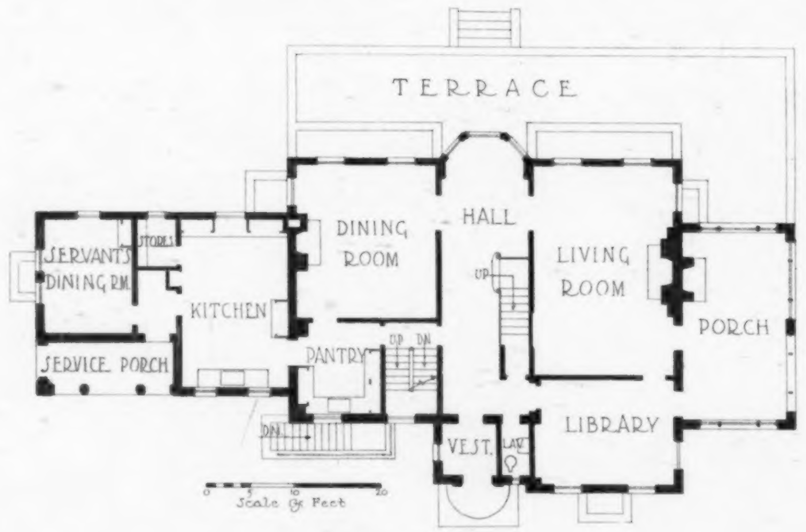
Plans on Back

GARDEN ELEVATION

HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.

PHELPS BARNUM, ARCHITECT

SECOND FLOOR



FIRST FLOOR

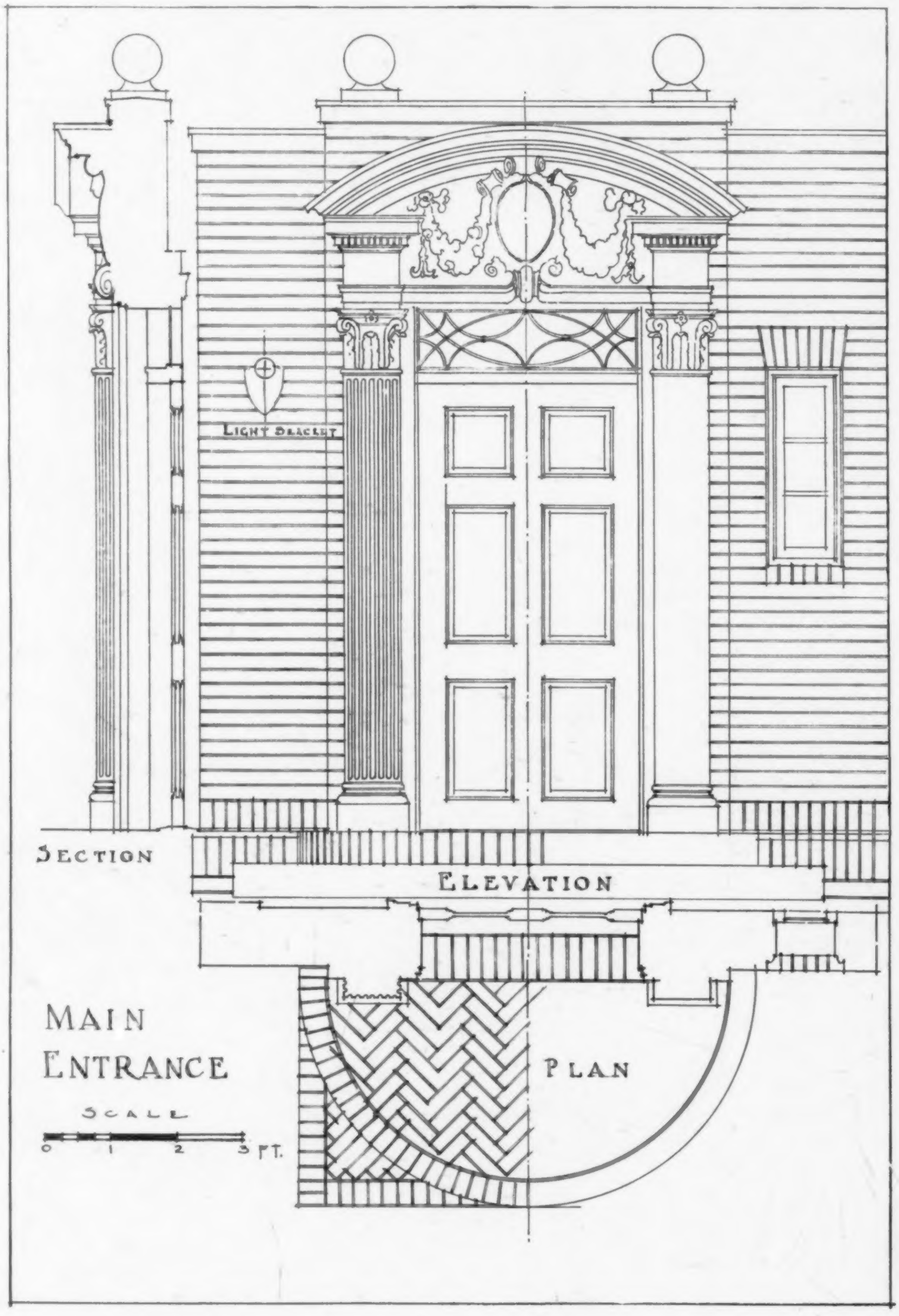
PLANS: HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.
PHELPS BARNUM, ARCHITECT

Details on Back

ENTRANCE DOOR

HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.

PHELPS BARNUM, ARCHITECT



HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.
PHELPS BARNUM, ARCHITECT

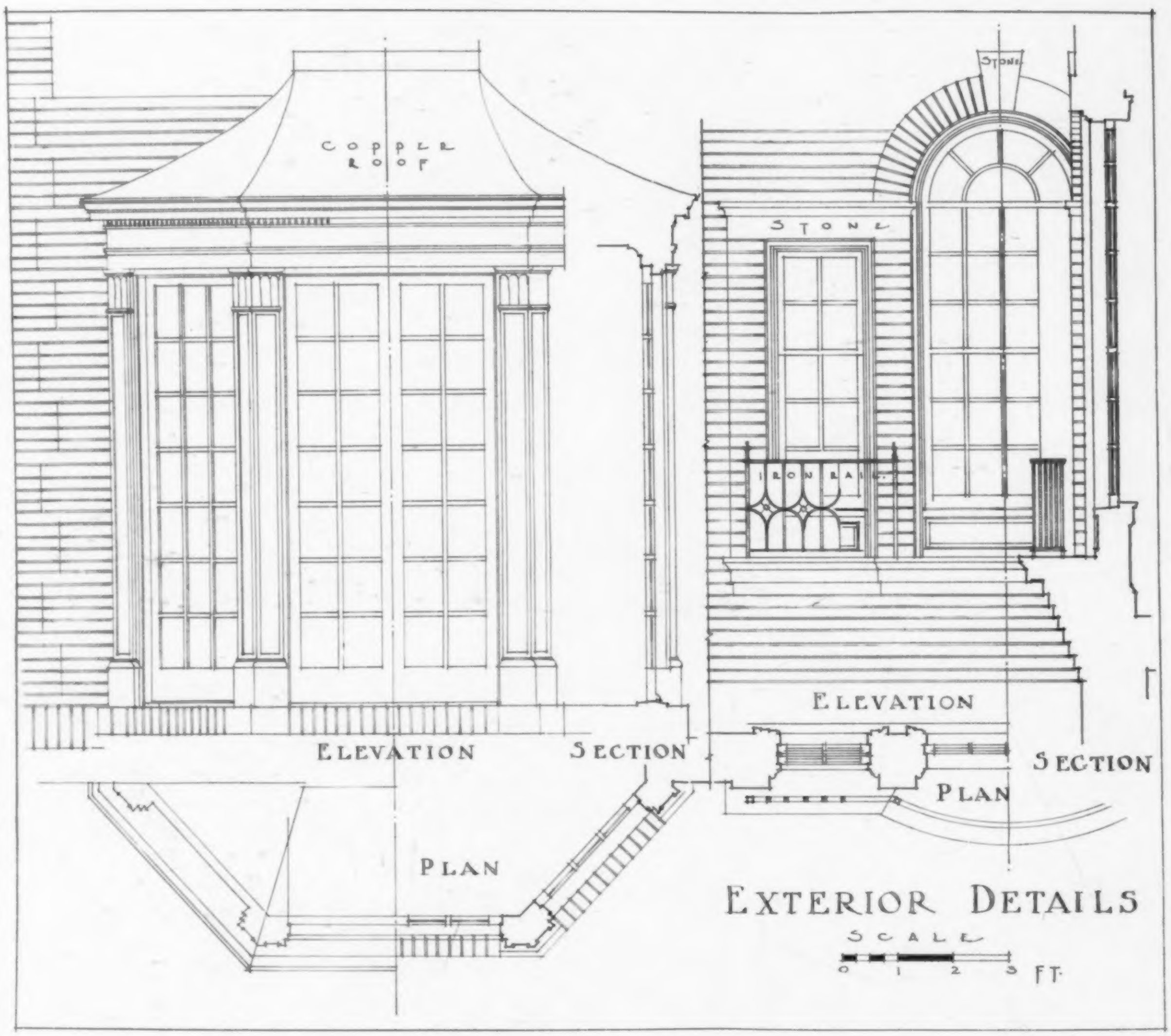
LIVING PORCH AND GARDEN
HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.
PHELPS BARNUM, ARCHITECT

Details on Back

CORNER OF ENTRANCE HALL BAY

HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.

PHELPS BARNUM, ARCHITECT



DETAILS, ENTRANCE HALL BAY AND WINDOW ABOVE LIVING PORCH

HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.

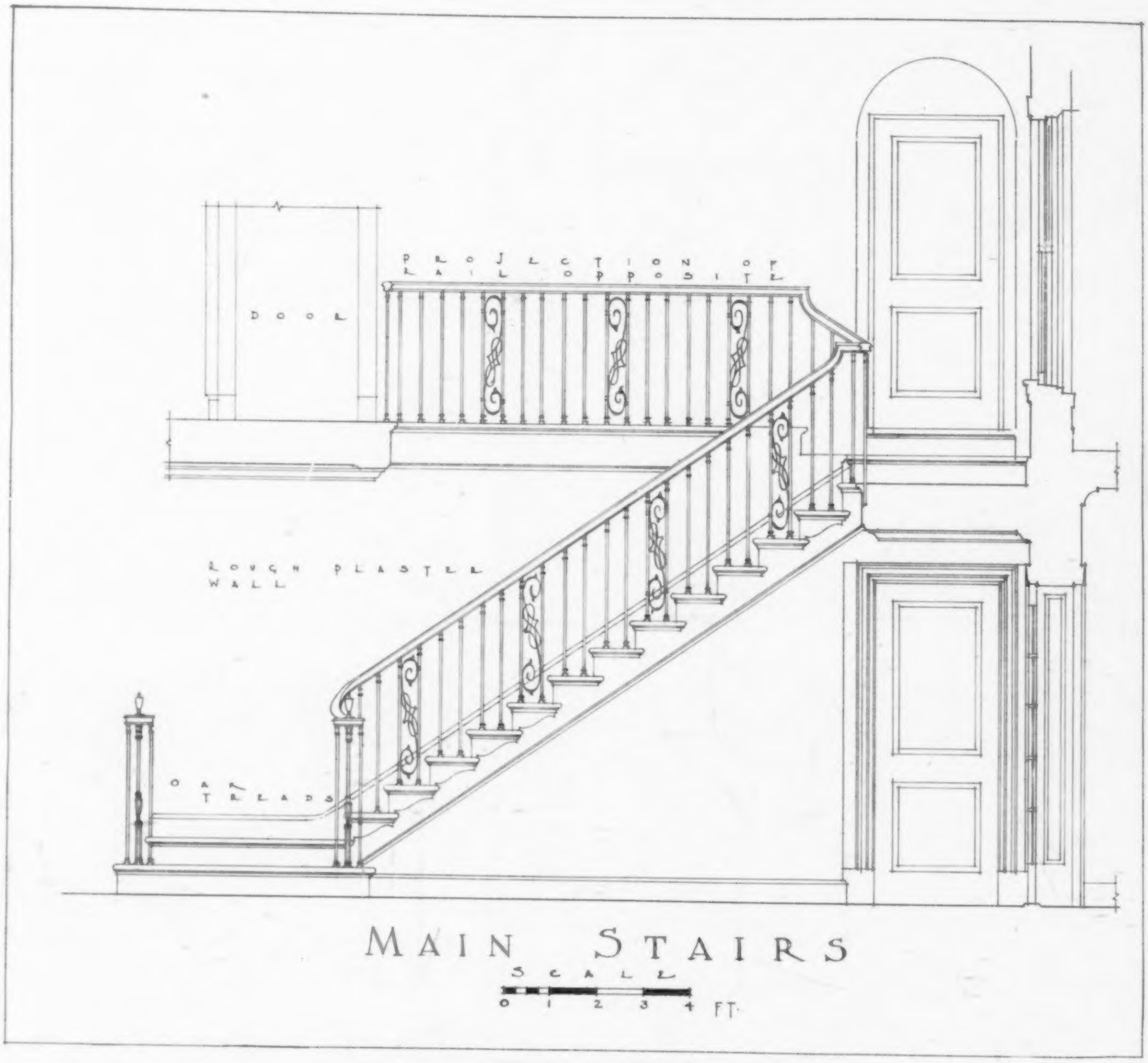
PHELPS BARNUM, ARCHITECT

LIVING ROOM

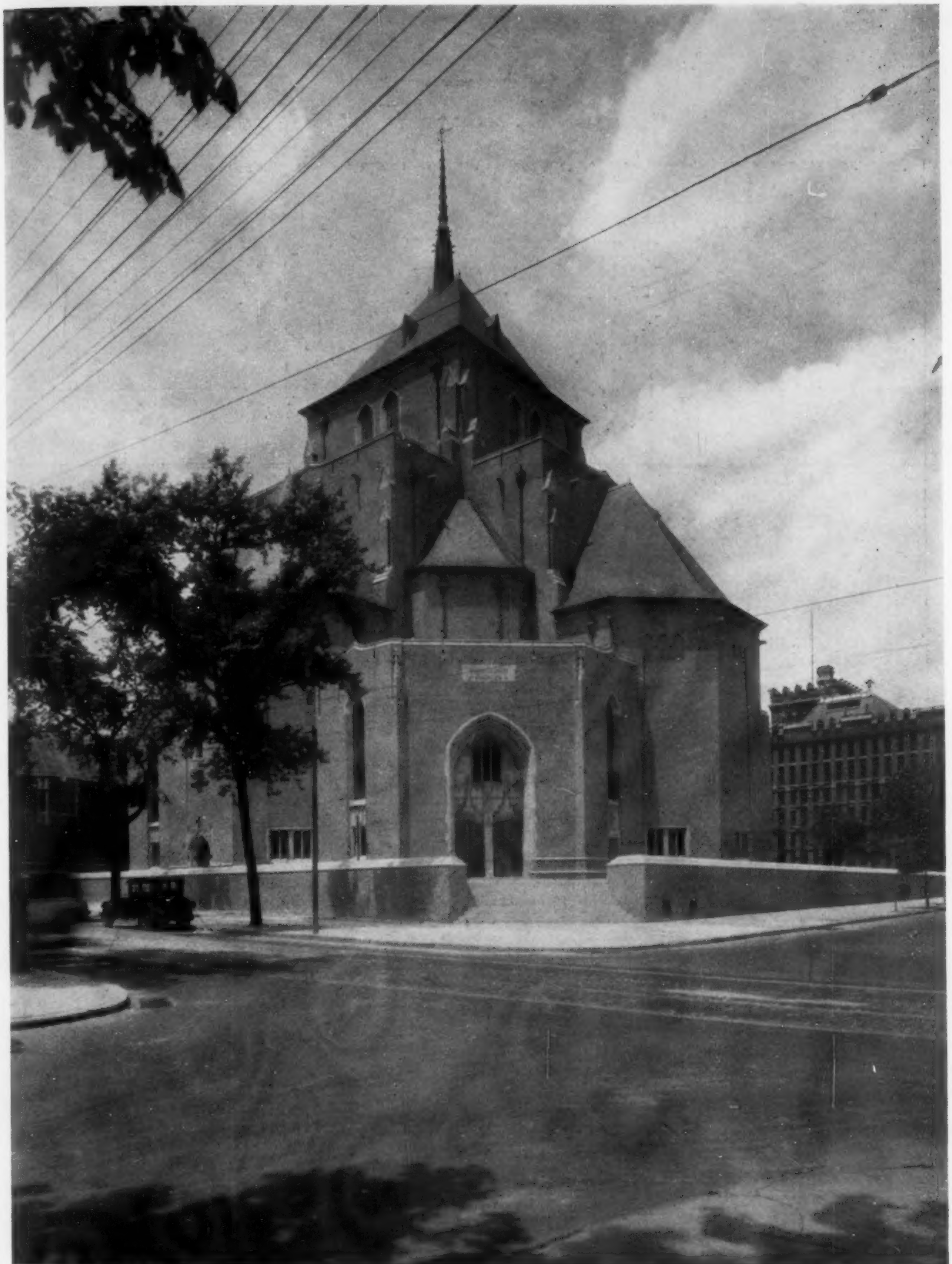
DINING ROOM

HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.

PHELPS BARNUM, ARCHITECT



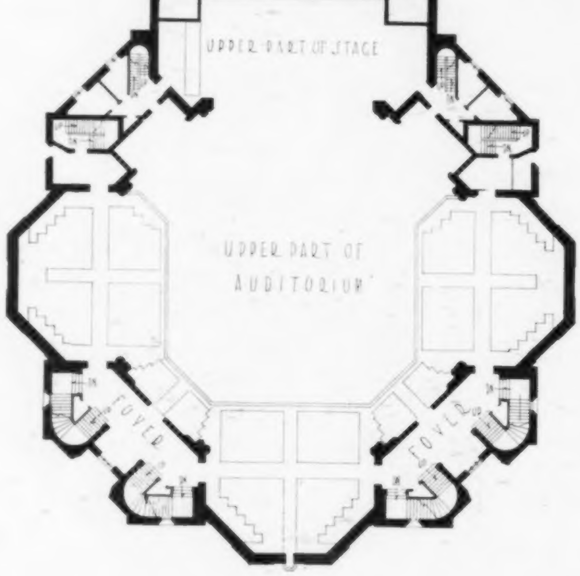
HOUSE OF E. H. BAKER, ESQ., GREENWICH, CONN.
PHELPS BARNUM, ARCHITECT



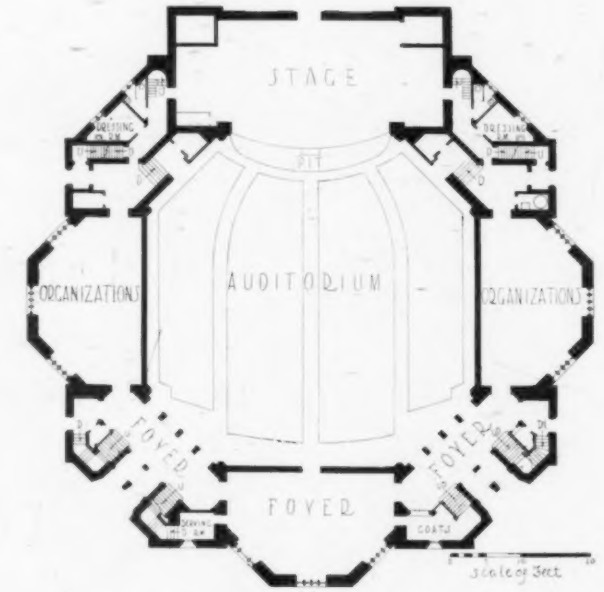
Photos. Paul J. Weber

Plans on Back

WILLIAM B. IRVINE AUDITORIUM
UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA
HORACE TRUMBAUER, ARCHITECT



BALCONIES

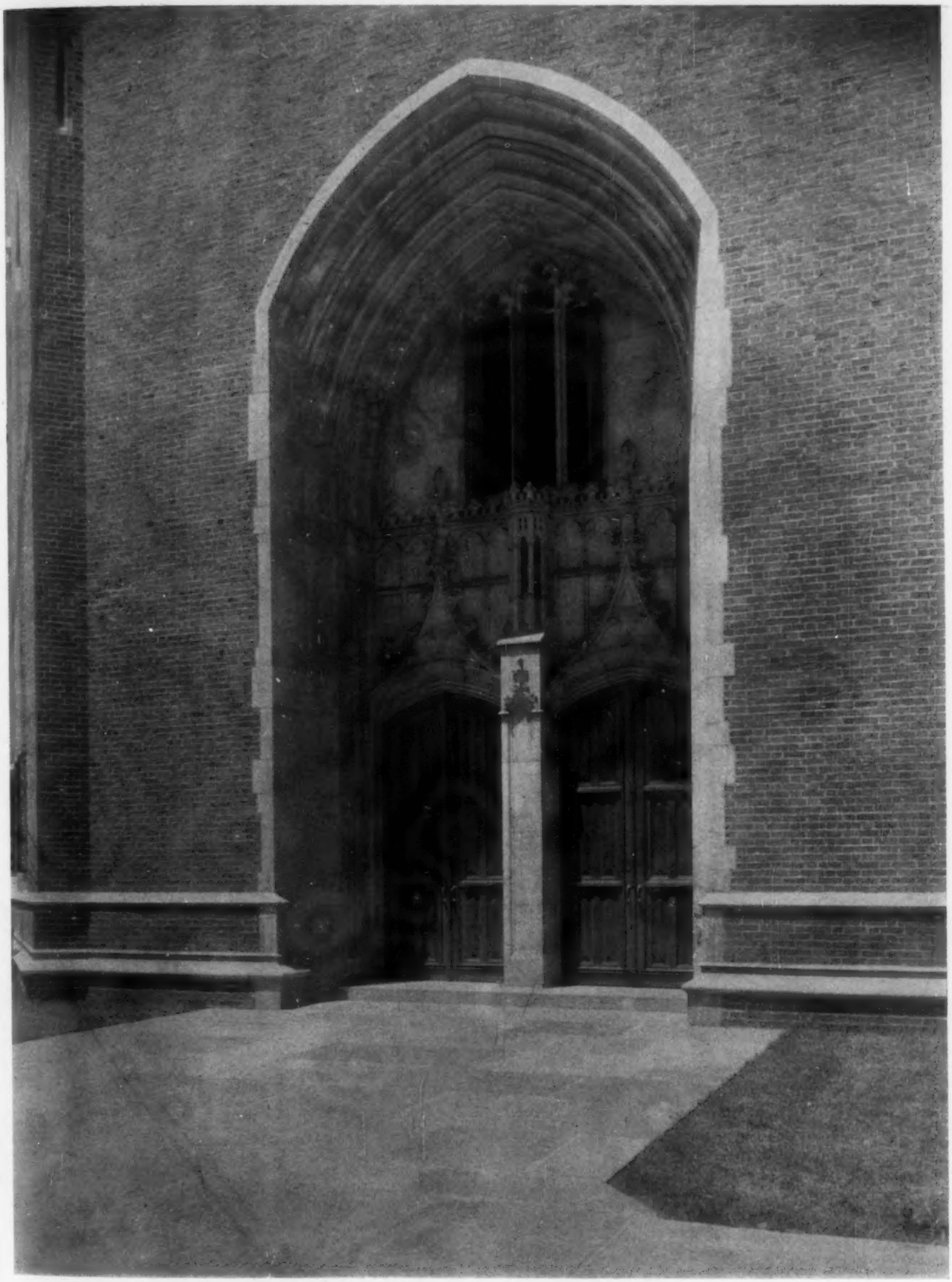


MAIN FLOOR

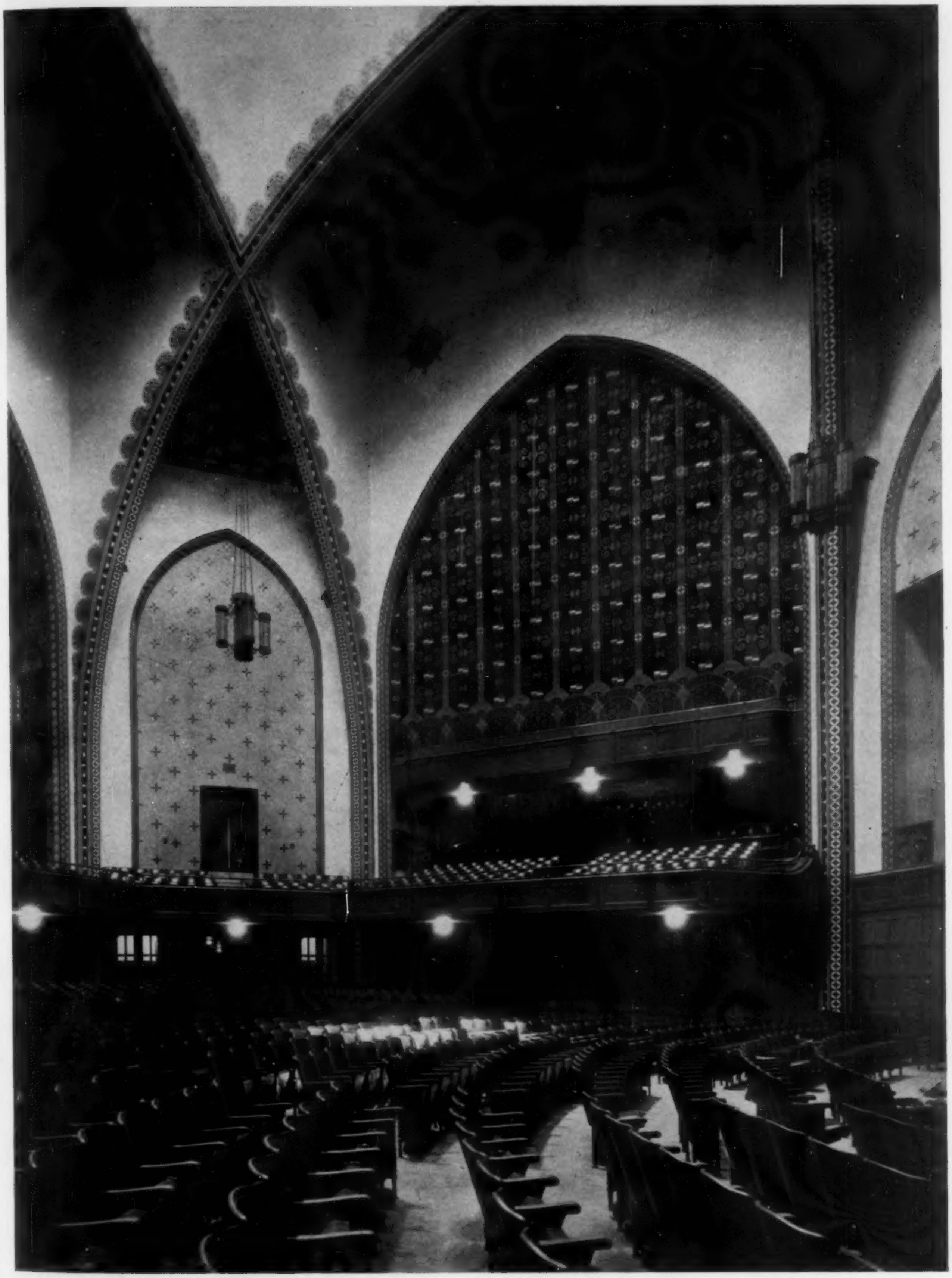
PLANS: WILLIAM B. IRVINE AUDITORIUM

UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA

HORACE TRUMBAUER, ARCHITECT



ENTRANCE, WILLIAM B. IRVINE AUDITORIUM
UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA
HORACE TRUMBAUER, ARCHITECT



INTERIOR, WILLIAM B. IRVINE AUDITORIUM
UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA
HORACE TRUMBAUER, ARCHITECT

THE ARCHITECTURE OF DENMARK

PART II

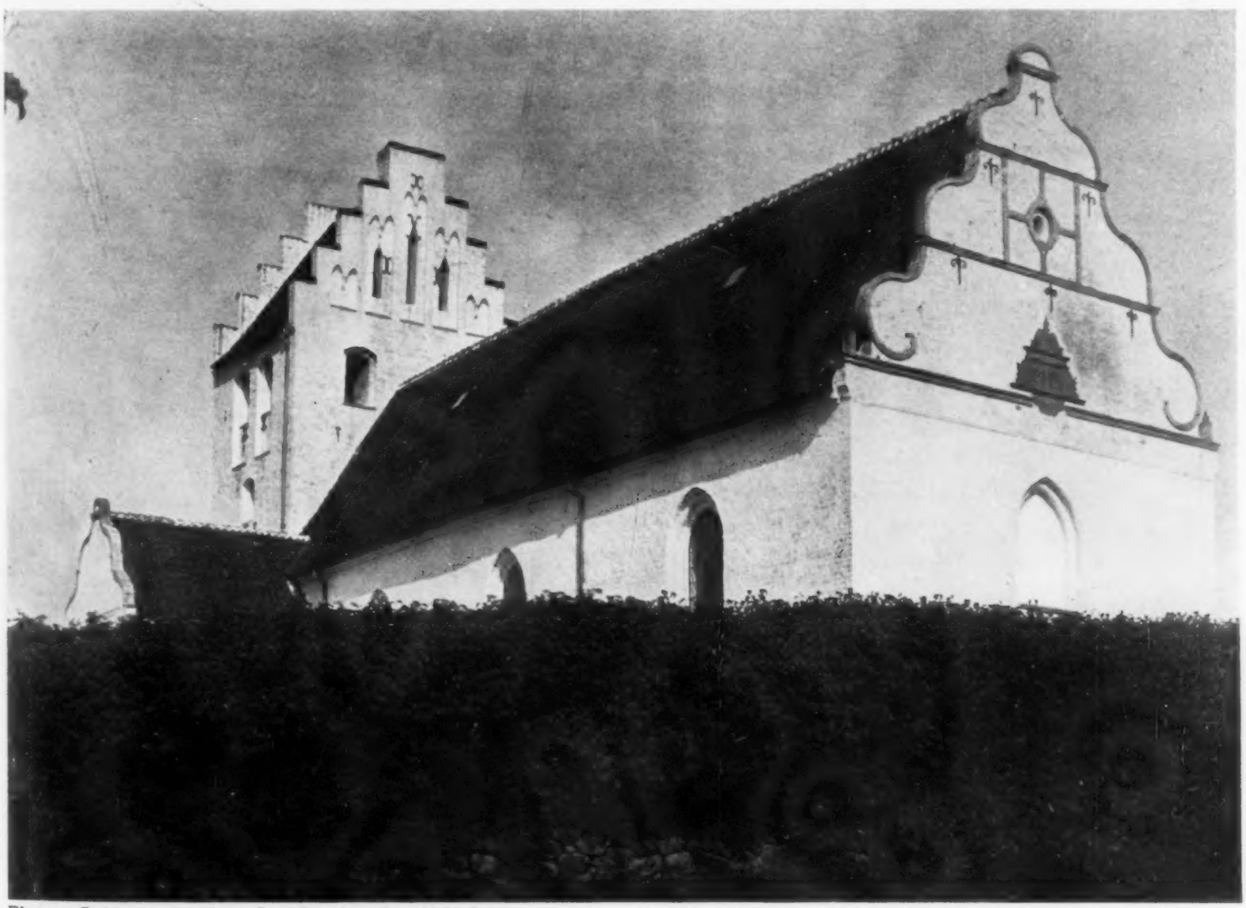
BY

DR. TYGE HVASS

BY decree of Frederick V, Amalienborg Palace was erected in Copenhagen in the decade from 1750 to 1760, under the supervision of the Danish architect Eigtved. This palace consists of four identical Rococo buildings, arranged around an octagonal plaza. On command of the king, these four palaces were erected by four of the great noble families, and the king insisted, although reciprocating with certain tax exemptions, that they should be constructed in accordance with the architectural plans of Eigtved which had received his approval. About 1770 the architect Harsdorff, influenced by the dawning classicism, connected two of the palaces with a colonnade, in simple classical style, with Ionic columns. By this device the palace plaza was more completely enclosed, its octagonal shape was further emphasized, and the impression of spaciousness greatly accentuated. Amalienborg is still the residence of the Danish kings, and it is conceded that the palace buildings form one of the most striking groups in Europe.

The story of modern architecture begins about 1830, with the ebbing of the influence of the Empire period, with Soane in England, Schinkel in Germany, and Bindesboll in Denmark feeling their way toward use of new styles outside the outworn Empire. This attempt constituted in itself a new style. It indicated a break with the orthodox, an identification with earlier forms, and a subjection to the experience and genius of others. Archæology came to be recognized as a science, and it laid a cold hand on architectural experiments or originality. The academies and schools taught use of certain conventional styles, and assigned tasks and problems which had to be worked out in accordance with the dictates of those styles and within the artistic limits of a given century. These theoretical problems to a large degree did violence to the artistic actualities they were supposed to reproduce. Architects not only submit to the motifs taught in the schools and guide books, but seek them everywhere. They try their hand at Renaissance, Baroque, Rococo, Romanesque and Gothic styles, and from all sides they are deluged with illustrative material in the form of books of plans and of photographs, prints, and even post cards.

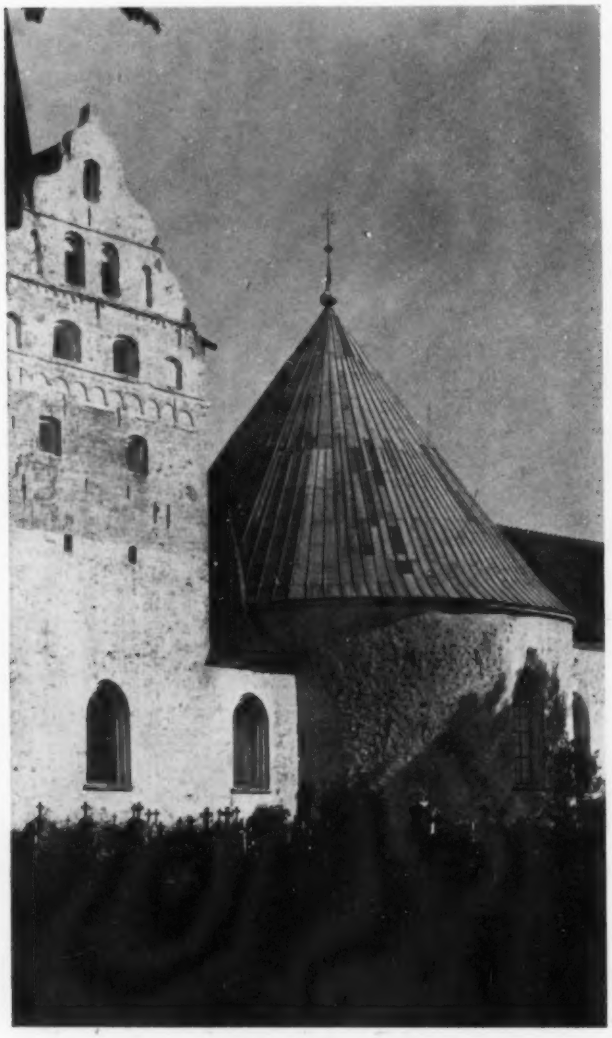
We have noted Bindesboll as one of the first who sought to break away from the use of the conventional Empire style. Around 1840 the influence of classicism was ebbing away, but under the genius



Photos. Courtesy American Scandinavian Foundation

Church at Lyndelse, Denmark

of such architects as Hansen it had meant immeasurably much to Denmark. To Hansen we owe such great architectural monuments as Christiansborg Palace, Our Lady's Church, the Copenhagen Court House, and many other public buildings. His edifices were correct, dignified,—and academic. The possibilities of this Neo-classical style soon appeared to be exhausted, and architects turned hopefully to new experiments. In 1838 Thorwaldsen's Museum was erected after the plans of Bindesboll. It was the last major effort of the Empire period, an original and splendid conclusion to that classicism which erected so many proud memorials to itself in Danish architectural history. Thorwaldsen's Museum, however, was a unique effort of Bindesboll, and it stands quite apart from his other and later buildings which were quite styleless and characterized by a strict economy of line and by the extent to which proportions and construction determined the form. Bindesboll can scarcely be said to have established a school, for he was professor at the academy for but one year; but it was his pupil, Herholdt (1818-1902) who, under the inspiration of Bindesboll's personality and genius, directed Danish architecture into new and independent channels. Herholdt gave to Danish architecture new points of departure and the possibility of more healthful and natural development. The old springs had dried up, but he knew the way to fresh springs where many generations might drink of the waters of inspiration. The springs to which he turned flowed bountifully from the Danish soil; it was back to the old Danish domestic architecture that he led the way. His most important achievements,—the library of the University of Copenhagen and the Copenhagen railroad station, now no longer standing, were in many respects path-breaking for Danish architectural development. For even though these buildings show the influence of north Italian architecture, both in conception and in fulfillment, they show a rare freedom and independence, which have exerted a profound influence on the course of Danish architecture. Here for the first time we can discover a positive national note in Danish architecture. And yet, synchronously with this development of national traditions, there was a constant influence from Italy, still the goal and training place for Danish artists. It was always the north Italian Romanesque and Renaissance art which they sought to re-



Church at Horne, Denmark

Old Gate Tower, Stege, Denmark

produce and to interpret; not Classical or Baroque.

The most representative and incomparably the best work of this school is the famous Copenhagen Town Hall of Marton Nyrop. Work upon this magnificent building was begun in 1893 and concluded ten years later. Despite the Italian detail work, and the Veronese assembly room, the building is unmistakably national in character, and due to its democratic intimacy and simplicity it has remained one of the most popular buildings in the country. This Town Hall crystallizes a generation of devoted study of old Danish domestic architecture. All that is most characteristic and national in the great Renaissance palaces, the old churches, and the memorial houses, is reincarnated in this architectural masterpiece. The same genius is also evident in the use and combination of the different building materials. Each material has been used in accordance with individual demands and possibilities, and as a result the building is an example of a technical mastery of material unparalleled in any other work of the entire modern period. Nyrop's masterpiece has become a point of departure and a model for a new school of architecture in recent years. The Town Hall has proved a source of inspiration for Danish craftsmanship, and will continue to do so.

More recent architectural developments, however, have taken quite another direction. Influenced by the work of Morris in England and Schultze-Naumburg in Germany, Danish architects became aware of the significance of the building as a whole, as a living and unified organism, of the character of the building in relation to its environment, and of the logic of the use of materials and plan in relation to function. Once again the architects turned back to the older Danish buildings, not, however, to the splendid castles or elegant manor houses, but to the individual burgher homes. In the beginning, as was quite natural, architects attempted to borrow and to copy motifs from the older buildings, but it was not long before a more independent attitude was developed, and there came a realization that it was possible to fit the individual house into the Danish landscape or the old Danish towns without resorting to a blind imitation of old styles. This attitude obtains at the present time and is the characteristic note in present-day Danish domestic architecture. In 1906 the eminent art critic, Wilhelm Wanscher, published

Roskilde Cathedral, Denmark

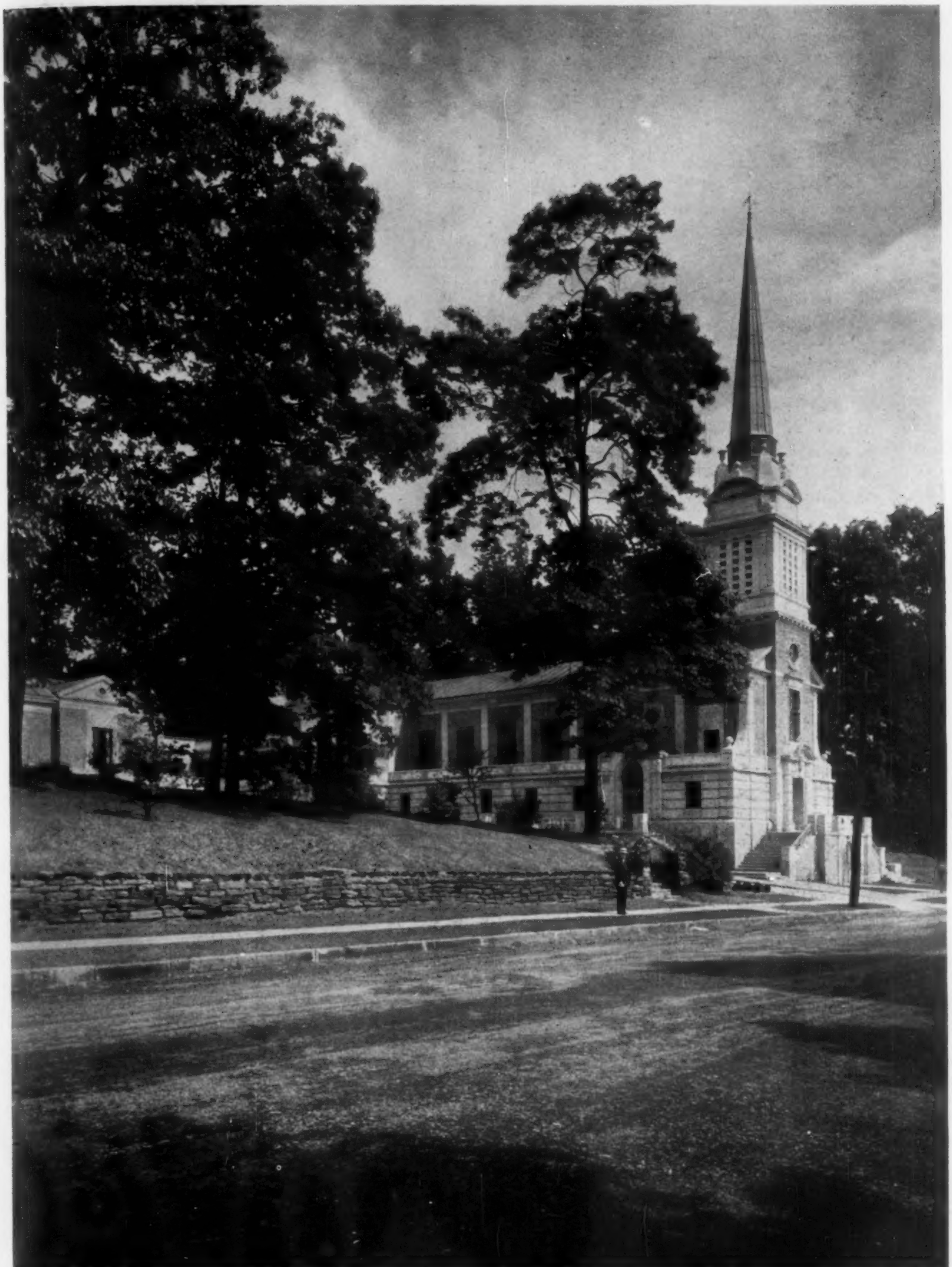
Arreskov Mansion, Denmark

his "Æsthetic Interpretation of Art," and his volume communicates a lively understanding of what art actually is. Through his books and lectures Wanscher has influenced a group of architects of his own age,—the so-called "free" architects, who withdrew from the Academy of Art, then under the leadership of Kampmann and Nyrop, as a protest against it. The leading spirits of this young group were P. V. Jensen-Klint, Carl Petersen, Baumann and Ivar Bentsen. Jensen-Klint, the oldest of the "free" architects, has made a signal contribution by his zeal in encouraging the old craftsmanship through his numerous writings and lectures. But it is in his architecture, itself independent and original, that he has given best expression to his principles. This is especially noteworthy in his adaptation of the old country church architecture to modern uses, the most distinguished example of which is the magnificent Grundtvig Church of Copenhagen, not yet completed.

For a number of years the ideals of the "free" architects dominated the shifting currents of Danish architecture, and though they had at first repudiated the Academy, they eventually captured it. When Carl Petersen died he was a professor at the Academy, and Ivar Bentsen occupies this position today, and it was Carl Petersen, himself not remarkably productive, who came to exert the greatest influence on the direction of contemporary Danish architecture. A direct product of his influence is the new Police Headquarters in Copenhagen. To Kampmann was assigned the task of carrying this great piece of work to conclusion, but swept away by his enthusiasm for the ideas of the modernists, he allowed the younger group a free hand here. The artistic work on this monumental building is that of Aage Rafn; the building itself is a reproduction of classical models,—part of a general European movement which seems already to have run its course.

Despite all of these changing interpretations and shifting currents, Denmark has fortunately escaped, during these hectic years, most of the architectural eccentricities and abnormalities which have appeared in other countries. The explanation of this good fortune is not easy to discover, but it is probably to be found in the sober, conservative and democratic character of the Danish people and in the fact that Denmark is so small that each individual artist is subject to an alert and highly penetrating criticism.

Cathedral at Ribe, Denmark



Photos. Paul J. Weber

Plans on Back

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT

SECOND FLOOR

GROUND FLOOR

PLANS: CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT

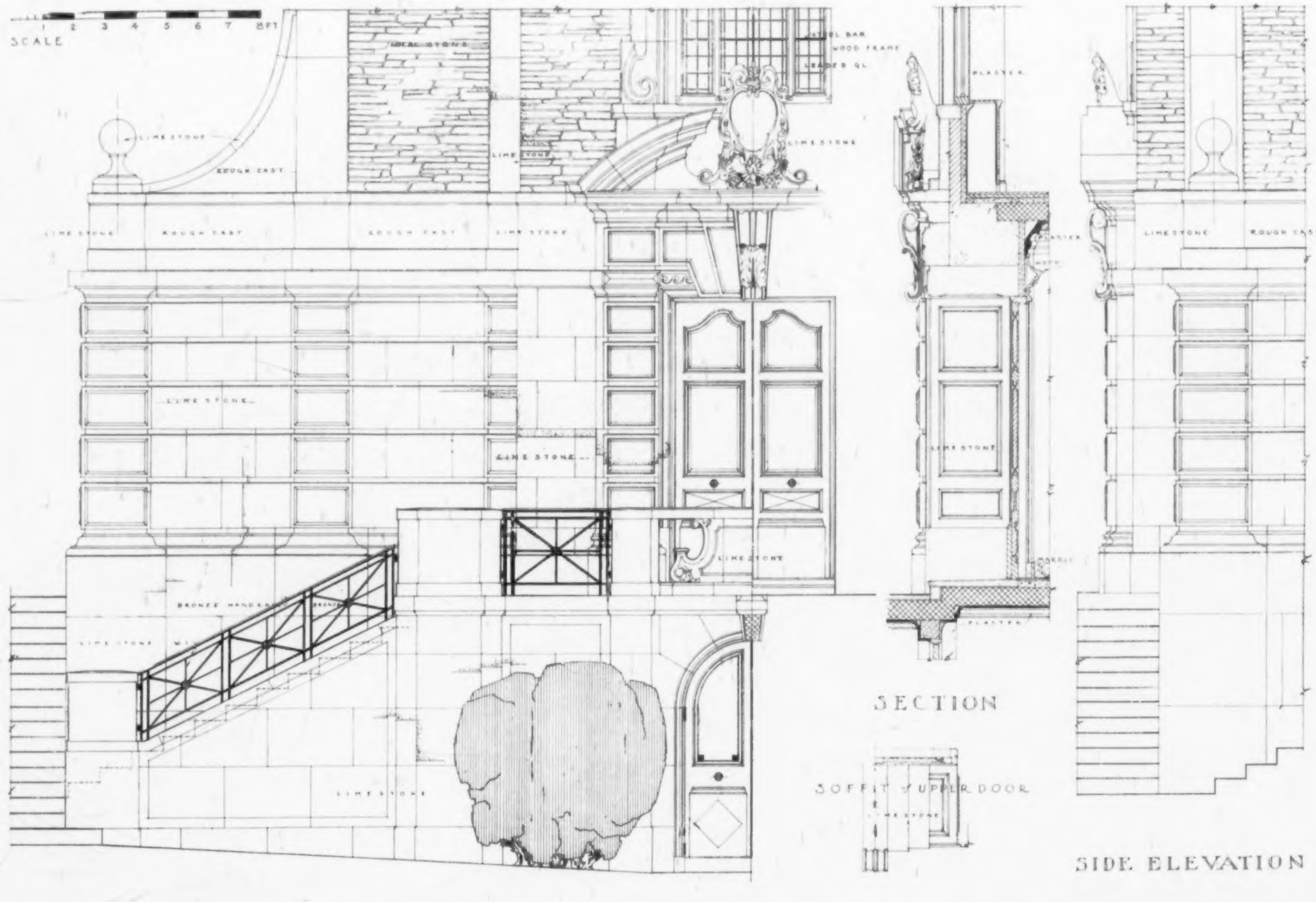
Details on Back

MAIN ENTRANCE AND STEPS

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT

The ARCHITECTURAL FORUM DETAILS



DETAILS of MAIN ENTRANCE DOORS & STEPS at WEST END of CHVRCH

NOV. 1928

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT

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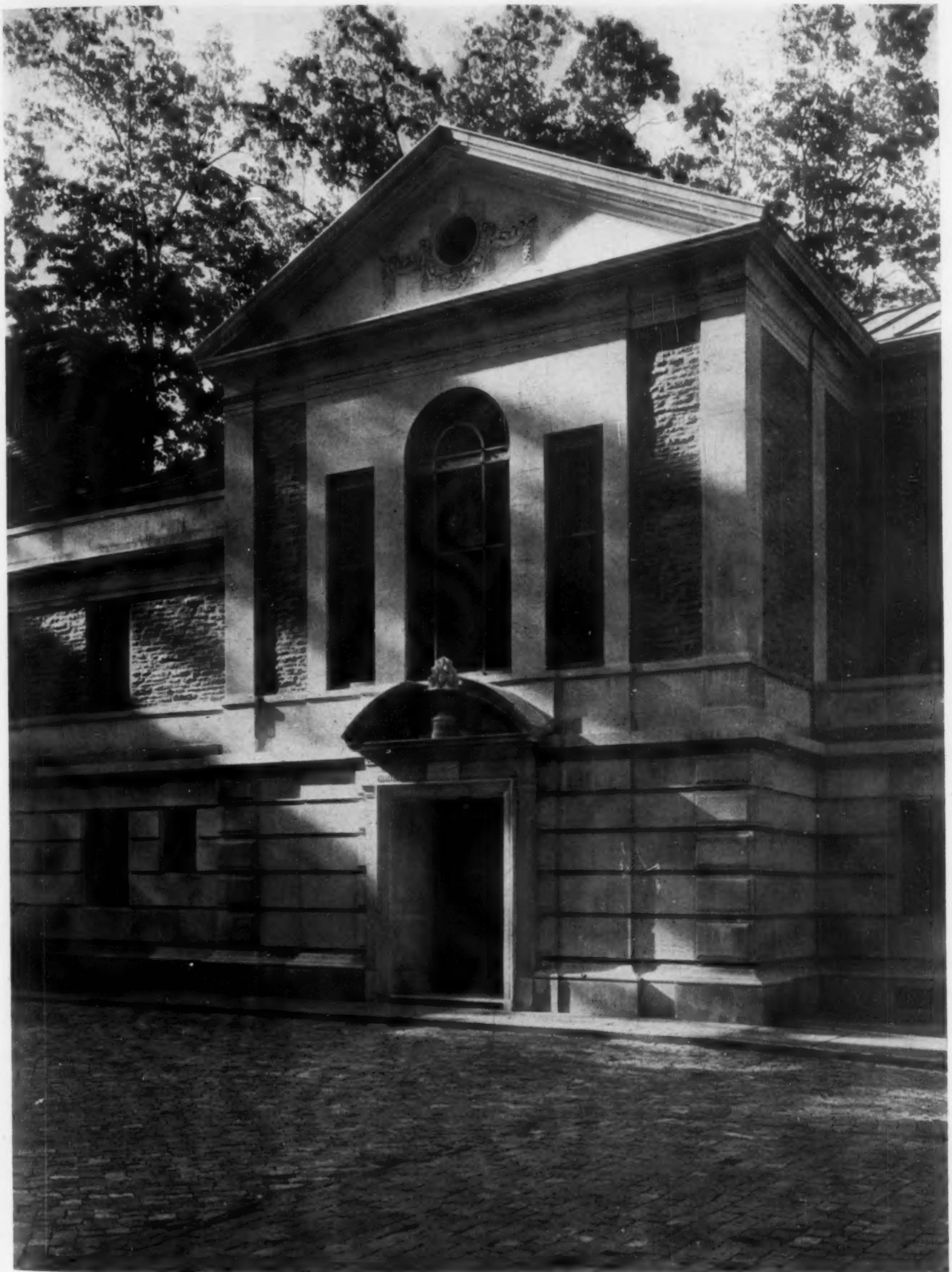
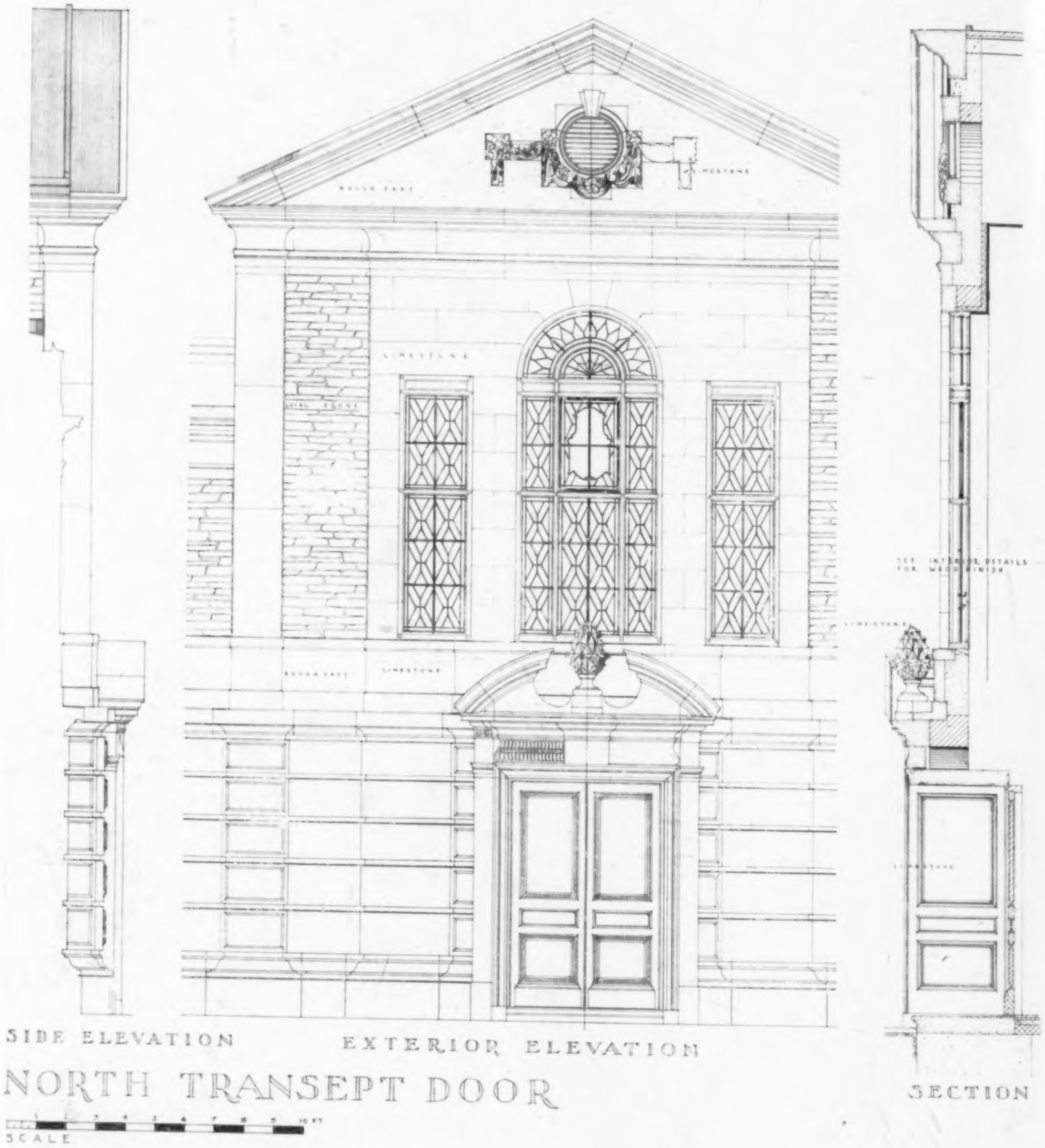


Details on Back

NORTH TRANSEPT
CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT



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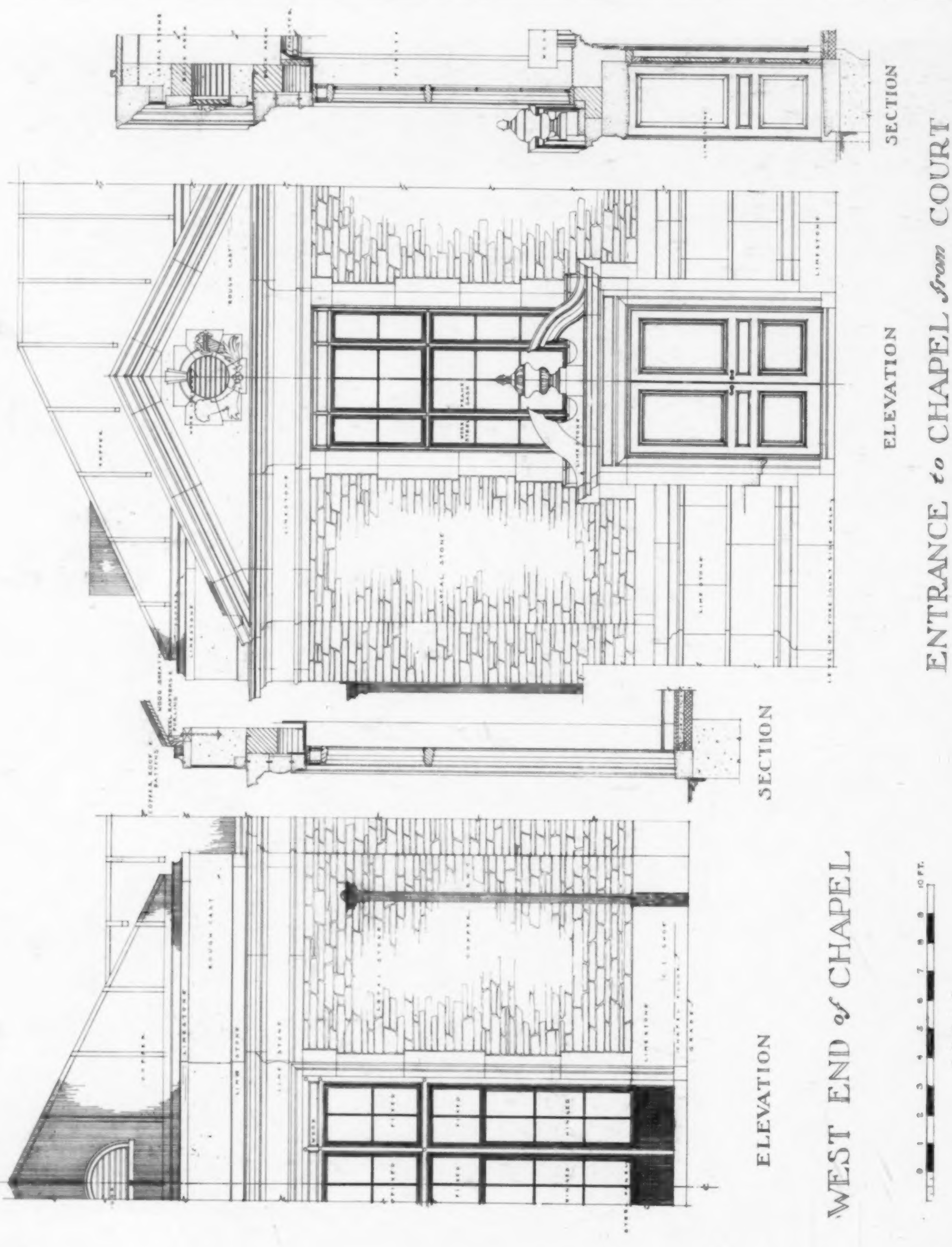
CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT

No. 87

The ARCHITECTURAL FORUM DETAILS

ENTRANCE TO NORTH TRANSEPT
CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT



NOV 1928

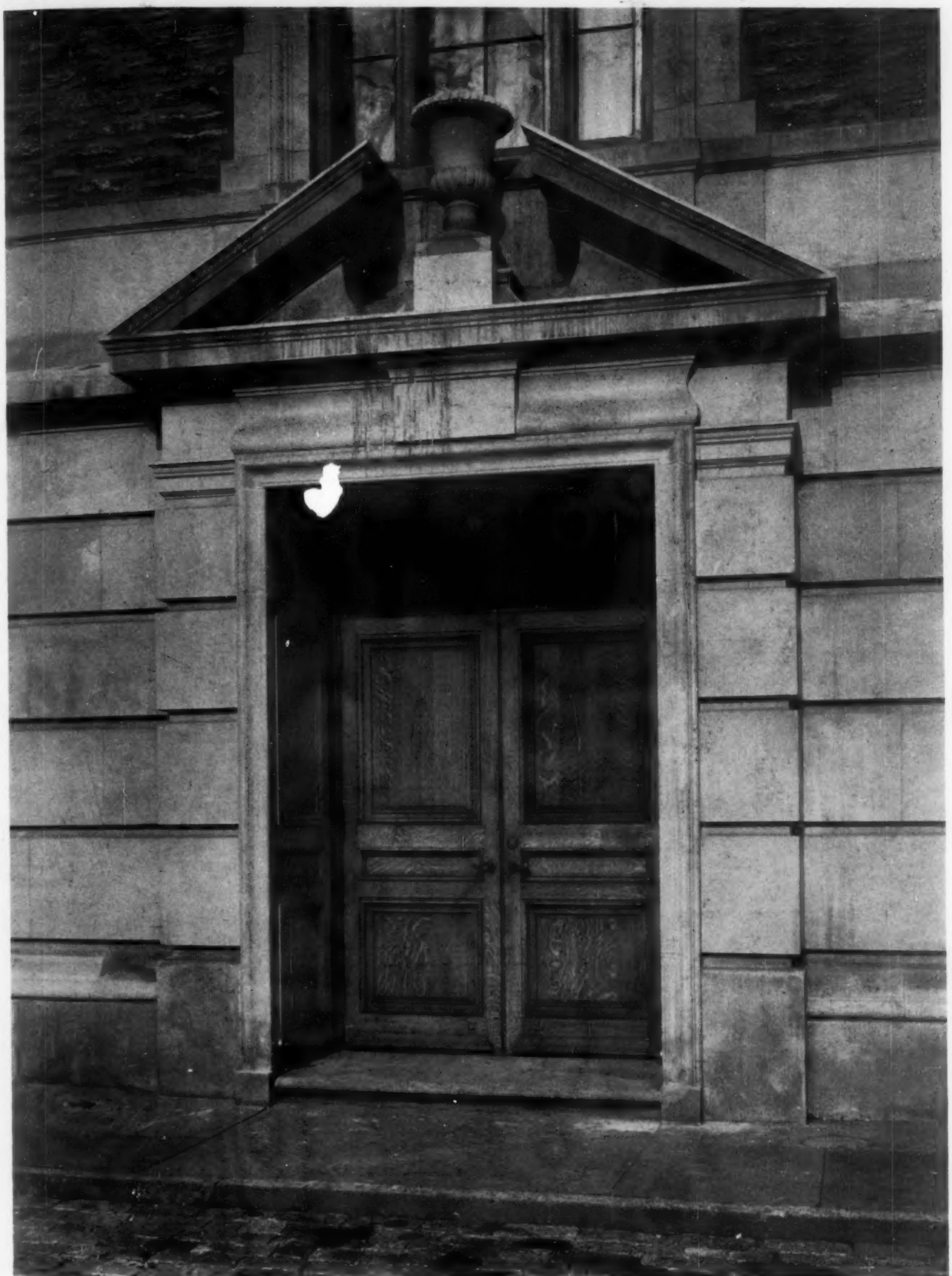
DETAILS, ENTRANCE AND WEST END OF CHAPEL

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT

No. 88

The ARCHITECTURAL FORUM DETAILS

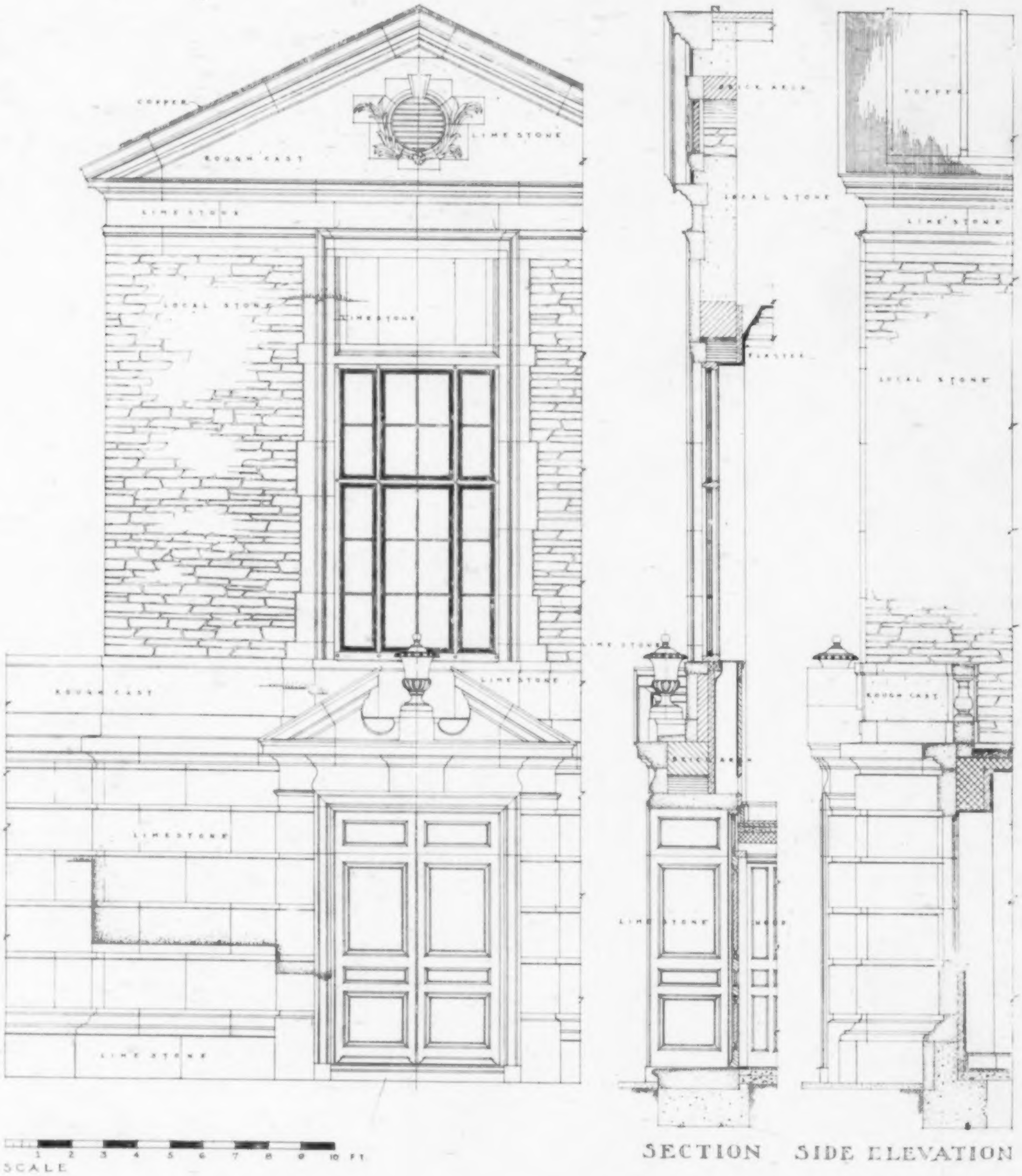


Details on Back

ENTRANCE TO THE PARISH BUILDING

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT



MAIN ENTRANCE DOORS TO PARISH BUILDING

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT

NOV. 1928

No. 89

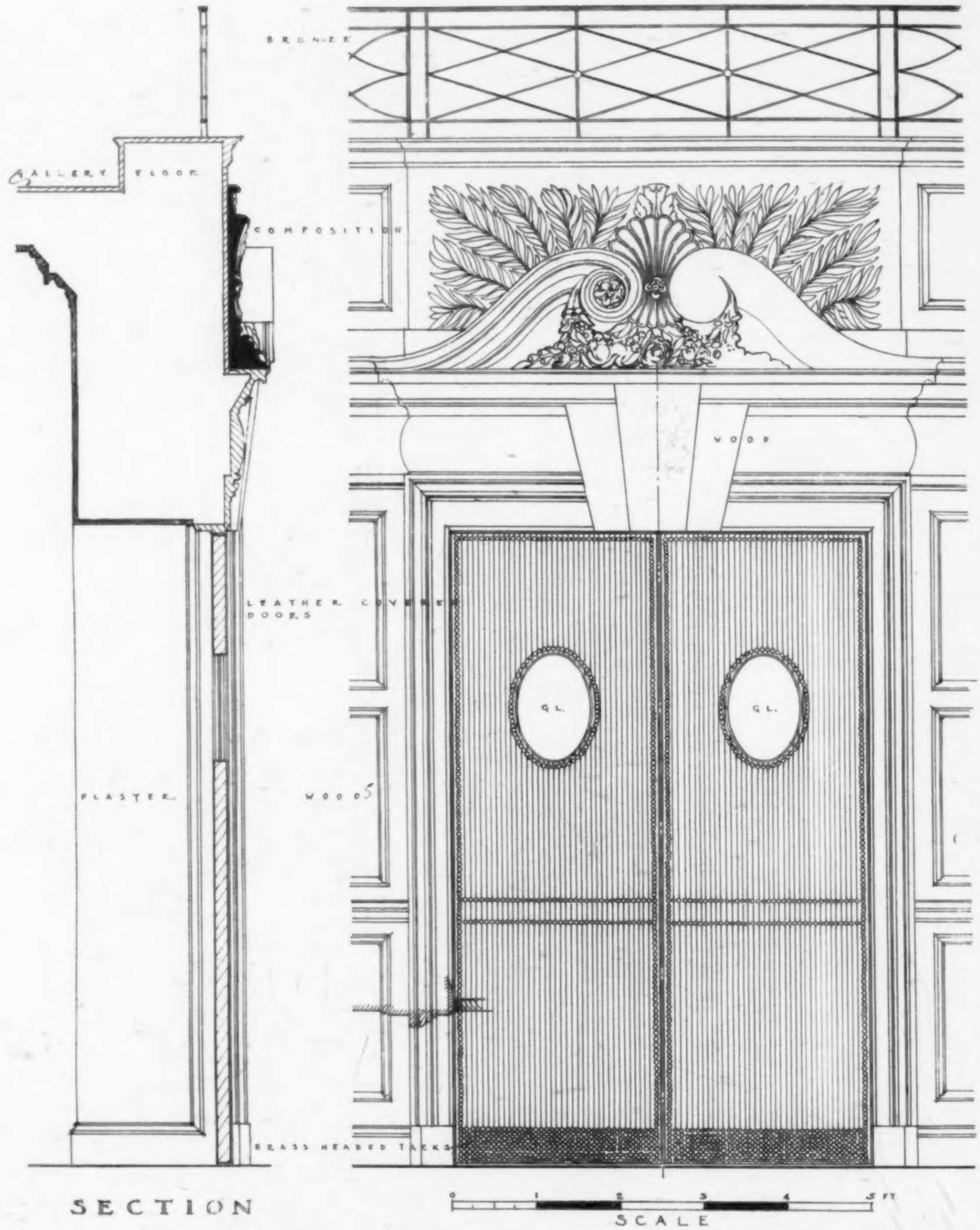
The ARCHITECTURAL FORUM DETAILS

Details of Door on Back

NAVE, FROM THE CHANCEL

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT



DOOR FROM NAVE TO MAIN LOBBY

NOV 1928

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT

No. 90

Details on Back

INTERIOR OF THE NORTH TRANSEPT DOOR
CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT

NORTH TRANSEPT DOOR

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT

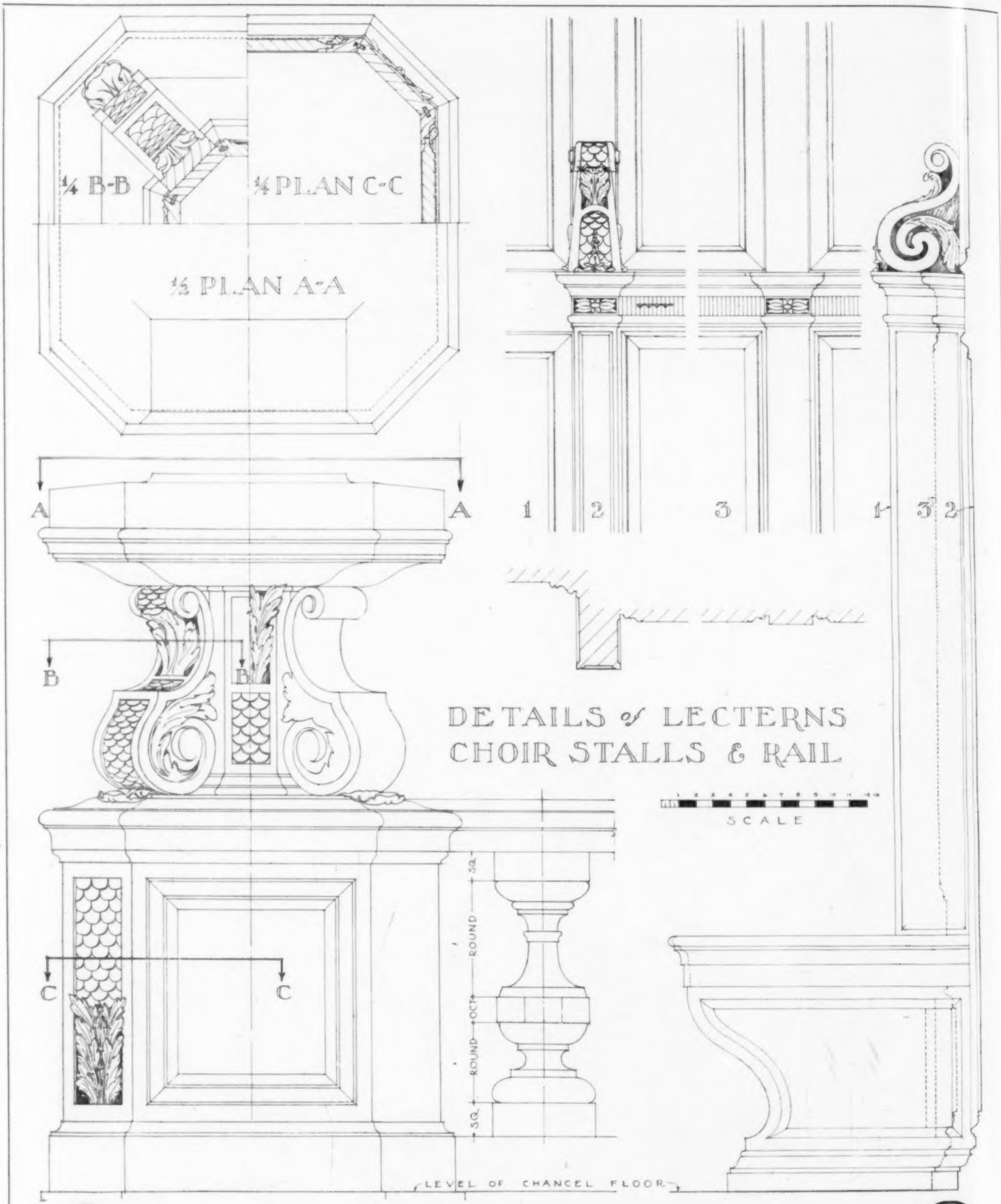
NOV 1928

No. 91

The Architectural Forum Details

Details on Back

LECTERN, RAIL AND CHOIR STALLS
CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT



NOV 1928

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT

No. 92

The ARCHITECTURAL FORUM DETAILS

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

BY

HAROLD D. EBERLEIN

EDMUND B. GILCHRIST, ARCHITECT

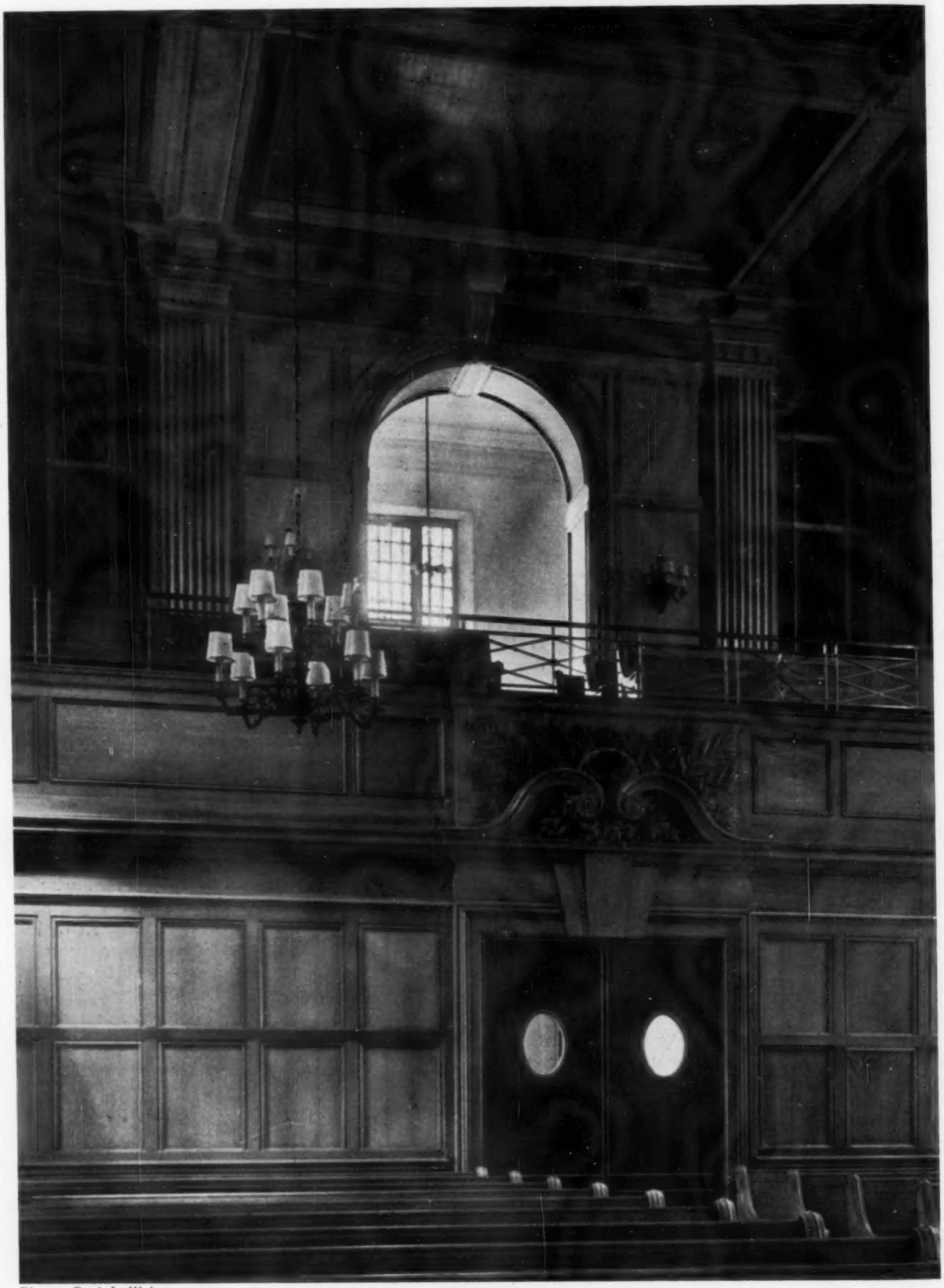
THE new buildings of the Unitarian Society of Germantown, Philadelphia, aptly point the perennial value of good manners. Good manners are always good and always pleasant, no matter what minor differences occur between the expressions of one age and those of another. And architecture, after all, is or ought to be a true embodiment of the behavior and moral standards of the particular epoch to which it belongs. Of these buildings just finished for the Unitarian Society, the church itself, of course, is the chief feature of the group. But, besides the church, the group includes the pastor's study; a parish hall with committee and classrooms, a completely appointed auditorium with an adequate stage, and a fully equipped kitchen with a large pantry adjoining; and, in the farthest member or wing, a chapel and a library, in the latter of which will be placed the books and a number of other articles that once belonged to Joseph Priestley.

When the Society decided to abandon its former buildings on Walnut Lane, and erect on the Lincoln Drive a group more suitable to its needs, there was plainly expressed the desire that the new church edifice, together with its adjunct structures, should not display an emphasis of markedly ecclesiastical character. It preferred rather that there should be, so far as possible, a domestic quality and a general aspect of dignified but cordial hospitality. An explicit requirement of this sort, laid down at the outset, naturally had a distinct bearing on the choice of design. Any phase of Romanesque or Gothic was thereby at once ruled out of the field of consideration. At the same time, certain conservative sentiments had to be taken into account, and the Society was unwilling to commit itself unreservedly to any program of out and out modernism.

Mr. Gilchrist has reached a peculiarly happy solution of the somewhat unusual requirements proposed to him. He has not attempted to effect one of those unconvincing, half-digested compromises that occasionally thrust themselves on the view,—compromises that seem to hesitate irresolutely between rigid adherence to tradition and the unfettered license of modernism. In adopting a mode undeniably reminiscent of Sir Christopher Wren's usage of religious building, he has shown due appreciation of a fact, too often ignored,—that tradition rightly understood and employed is always a flexible and accommodating instrument. It might, perhaps, be more correct to say that the architect, in this instance, has used Wren's mode, not as a model to pattern after as far as circumstances would consistently admit, but rather as a point of departure, a robust stock on which to graft adaptations germane to the occasion, exercising therein a large liberty of interpretation,—and this has, in fact, been well done.

Wren was inherently a classicist by temperament. He was also an eclectic. To whatever extent one may or may not be inclined to designate him a stylist, he was certainly not a narrow purist with an obsession for meticulous observance of traditional proprieties. His eclecticism is clearly evident in his habitual choice and combination of elements drawn from divers sources. Upon a stock of pure classicism, wholly congenial to his natural temperament and mental attitude, he grafted the Baroque characteristics, which he had assimilated through French and Dutch channels, and then graced them with exuberant elegancies in the fashion of Grinling Gibbon. In this process of selection and combination he relied, not upon the sanction of established and approved precedent, but upon his own innate sense of fitness and proportion. It was this independence of action that gave Wren's work much of its freshness and vitality. But Wren, the stylist and eclectic, was conspicuously an embodiment of the Renaissance spirit, the spirit that dominated the age in which he lived. The humanism, the classic love of logic, order and symmetry, and the graceful perspicuity that were part and parcel of the Renaissance spirit, were also part and parcel of Wren's very nature. The mysticism, the spiritual ecstasy, the romantic exaltation, the ecclesiastical symbolism and imagery, that we customarily associate with the middle ages, touched no responsive chord in Wren's mentality. His age was the age of Doctor Harvey, of Sir Isaac Newton, of Galileo, and he marched wholeheartedly with the spirit of his age. How cold and lacking in appreciation was Wren toward all things Gothic and mediæval,—he was temperamentally incapable of understanding them,—may be seen at a glance by his work at St. Mary's, Warwick. He was altogether preoccupied with classicism and the manifestations of its strictly material and visibly human element.

No one would dream of attributing to Wren's churches a shadow of the spirit of ecclesiasticism. St. Stephen's, Walbrook, for example, is instinct with consummate grace, but it contains not a vestige of that mystic spirituality we inevitably feel pervading Westminster or York, Gloucester or Durham, Chartres or Bourges or, for the matter of that, San Zeno at Verona. To quote Wren's own words, he built his churches in what he called "a good Roman style" as distinguished from "the Gothlike rudeness" of the modes in which the mediæval builders worked. Wren's London churches are superb examples of Renaissance architecture and, as such, are worthy

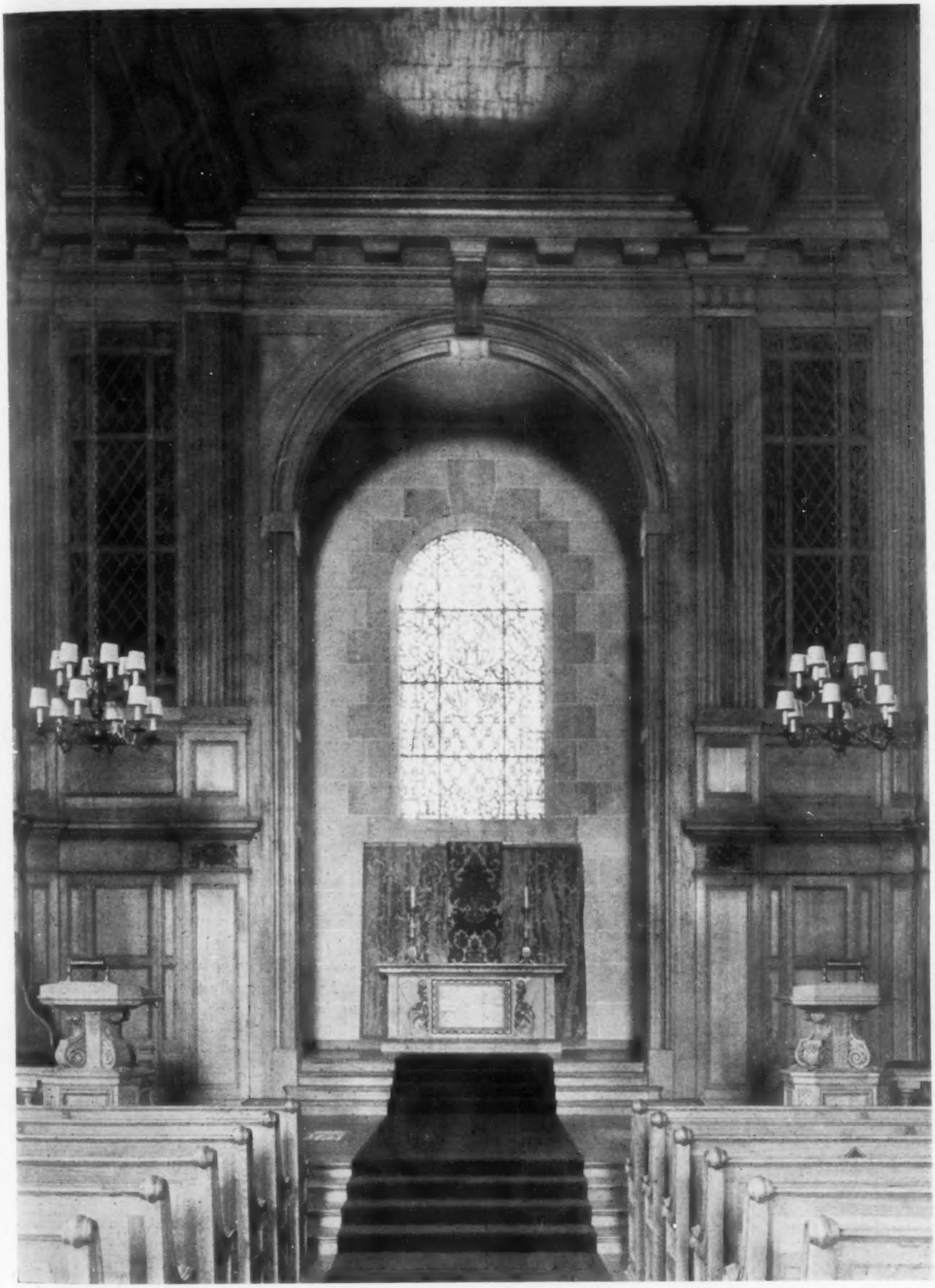


Photos, Paul J. Weber

DETAIL, WEST END OF NAVE

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT



DETAIL OF THE CHANCEL

CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.

EDMUND B. GILCHRIST, ARCHITECT

Detail of Tower and North Entrance

of all honor and deserve the most scrupulous preservation,—but ecclesiastical in spirit they are not. Since the Unitarian Society of Germantown expressly desired to eliminate the element of ecclesiasticism in this new building, and to emphasize rather the humanistic quality, what more fitting precedent could be found as a point of departure than the ideals embodied by Wren? Temperamentally they expressed the requirements of the occasion. The event, likewise, shows how congenial was this vein of expression to the architect. But, while accepting the spirit of the prototype, the architect, like Wren before him, has maintained his independence of interpretation. By so doing he has ensured that vital freshness that a too close observance of the letter inevitably destroys.

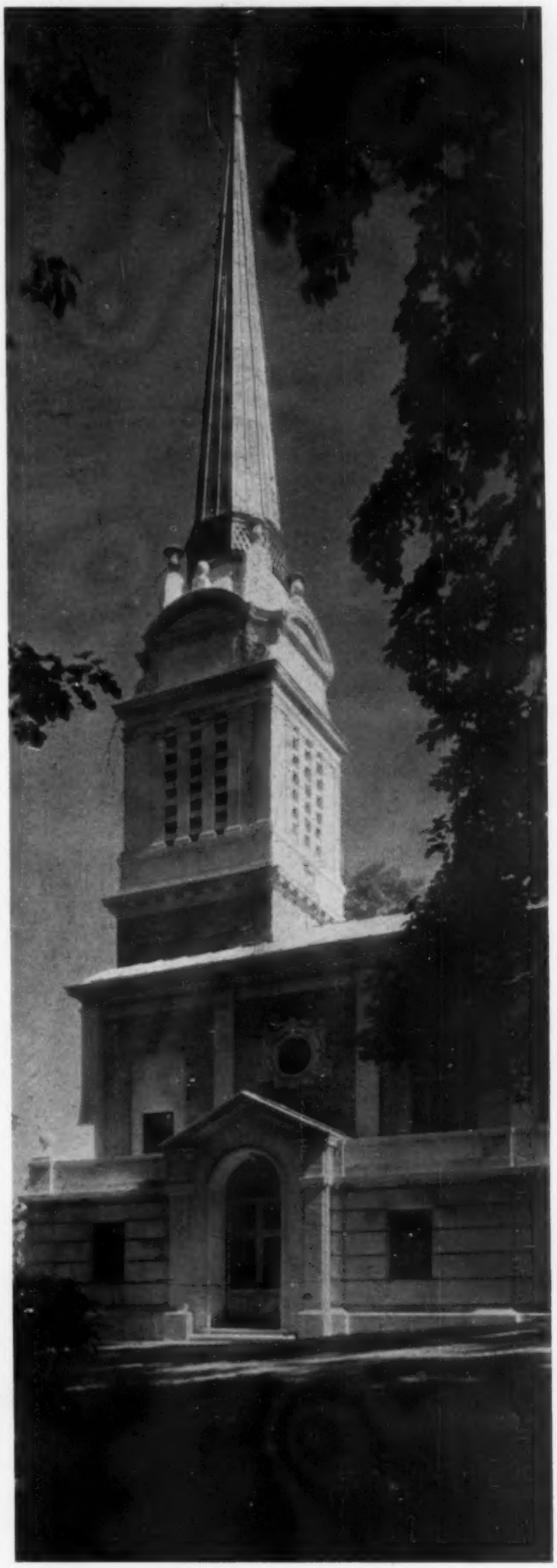
The exterior walls of the group are built of rubble-faced local gray ledge-stone, laid in thin courses with a horizontal accent; the outer walls of the aisles, the base courses of the parish buildings, and all the trim are fashioned in Indiana limestone. The rubble-faced clerestory walls are divided into bays by simple limestone pilasters whose equally simple caps die into the coved cornice in a very ingenious manner which finds its precedent, if any particular precedent it has, in the supple inventiveness of Baroque practice in seventeenth-century Italy, or the scarcely less adroit manipulations devised by French genius at the time of the Directoire. Were any disapproval to be voiced on the score of material, it would touch the disparity between the homespun quality of the rubble wall surfaces and the silken suavity of the limestone. The quantity of carefully dressed limestone, however, is so preponderant that the total effect carries the tone of complete and polished refinement. As a matter of fact, the rubble work is of exceptional excellence; the only touch of improvement to be suggested is that the rubble portions of the exterior be given a cement wash in accordance with the architect's wish. This would ensure more uniformity of finish without marring the very desirable element of contrast intended. After all, it is well to keep in mind the principle here exemplified in an unobstrusive way,—a principle well understood and acted upon by the old Italian builders, —that wall surfaces of any considerable extent admit great latitude in the diverse sorts and qualities of material used in their construction, so long as all the penetrations and all the edges of the mass are uniformly finished with a superior material and fashioned with decorous precision.

The tower and spire, from whatever point one views them, constitute a peculiarly felicitous and engaging composition. The lattice pattern in the panels of the octagonal drum at the base of the spire, and the vertical ribs of the spire facets, give a pleasant note of articulation that will become increasingly agreeable as the copper with which they, like the roof, are covered assumes its wonted weathering from oxidation. The bell stage, with its surmounting adornment of panels, pediments, carved scrolls

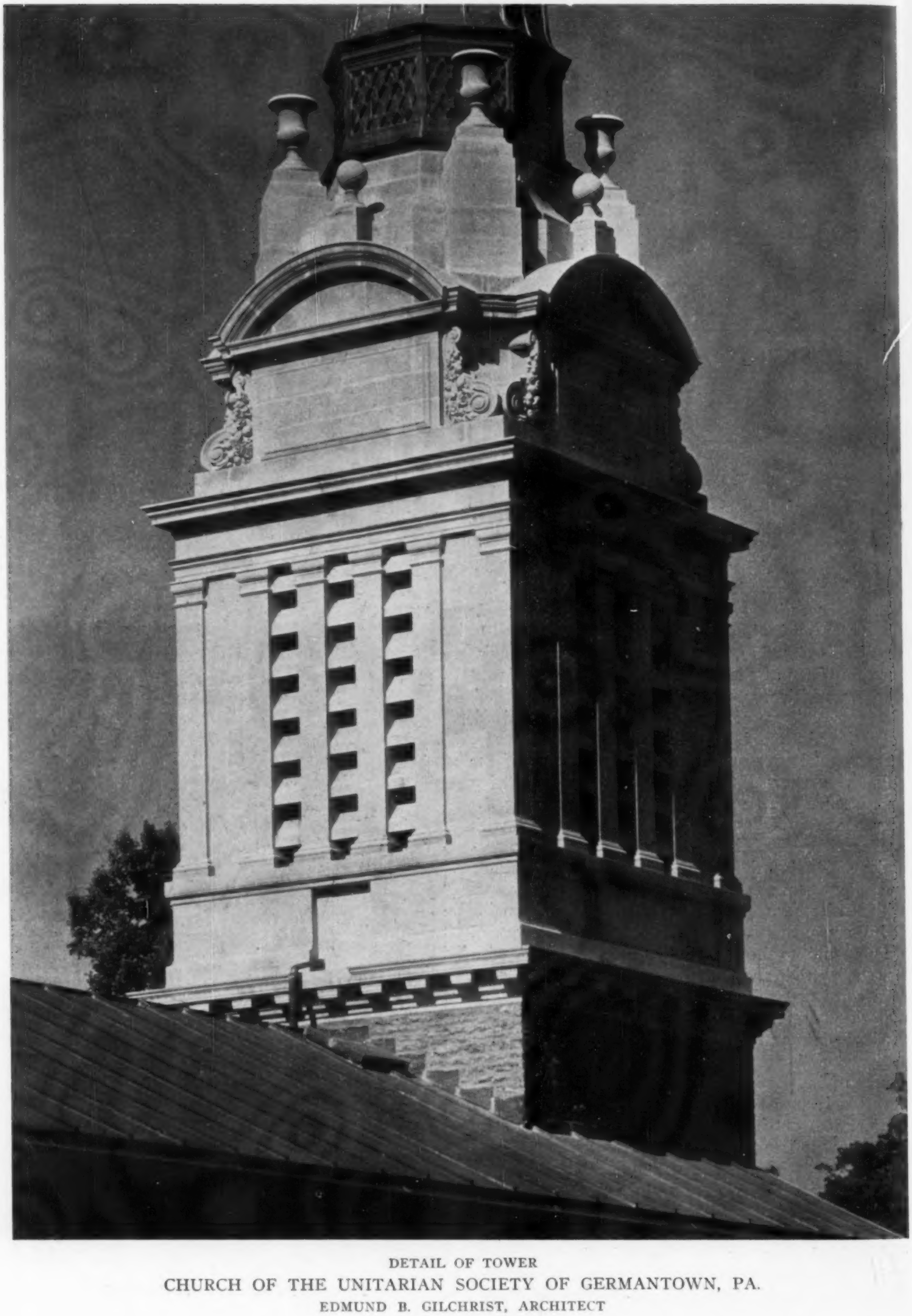
and urns, in a very convincing way combines serene, classic dignity with that spirit of blithesomeness which is both legitimate and desirable. The louver "boards," it will be noted, are of stone. Throughout the group, all the doors and the mullions of the square-headed windows are of oak, which is permitted to display its real color and character, undisguised by any of the usual and objectionable stains, fillers or finishes, save for a very slight fuming that merely tempers the newness until time and weather do their work. A narrow black band, next the glass, accentuates the character of the mullions and transom bars and adds sparkle and definition.

The interior of the church is no less arresting in its thoroughgoing distinction than is the exterior. In point of both material and color, the entire composition conveys to an unusual degree an unalloyed sense of satisfaction. All the woodwork is of oak, allowed to remain in its native state except for the slight and practically negligible treatment previously mentioned. To speak of *all* woodwork really means most of the interior. The walls are completely paneled up to the bases of the clerestory windows; the square piers between nave and aisles are encased in paneling, the pilasters defining the clerestory bays are of oak, and so are the cornice and the beams of the ceiling. Throughout the interior, the detail of the woodwork closely follows the manner of the late seventeenth century in England. As this mode was universal in the houses of that period as well as in Wren's churches, it serves to emphasize the domestic quality of the structure in a quite consistent manner, which was exactly what the clients wished. The same scheme of woodwork, it should be added, is continued through the other buildings of the group. In pleasant harmony with the dominant tone of the oak, the plaster of the clerestory walls is tinted a pale cream. Between the beams of the ceiling the panels are covered with silver paper coated with shellac, the result being a dull gold tone. The carpet and cushions of the pews are of rich red, and the swinging doors at the end of the church are covered with red leather and studded with brass-headed nails.

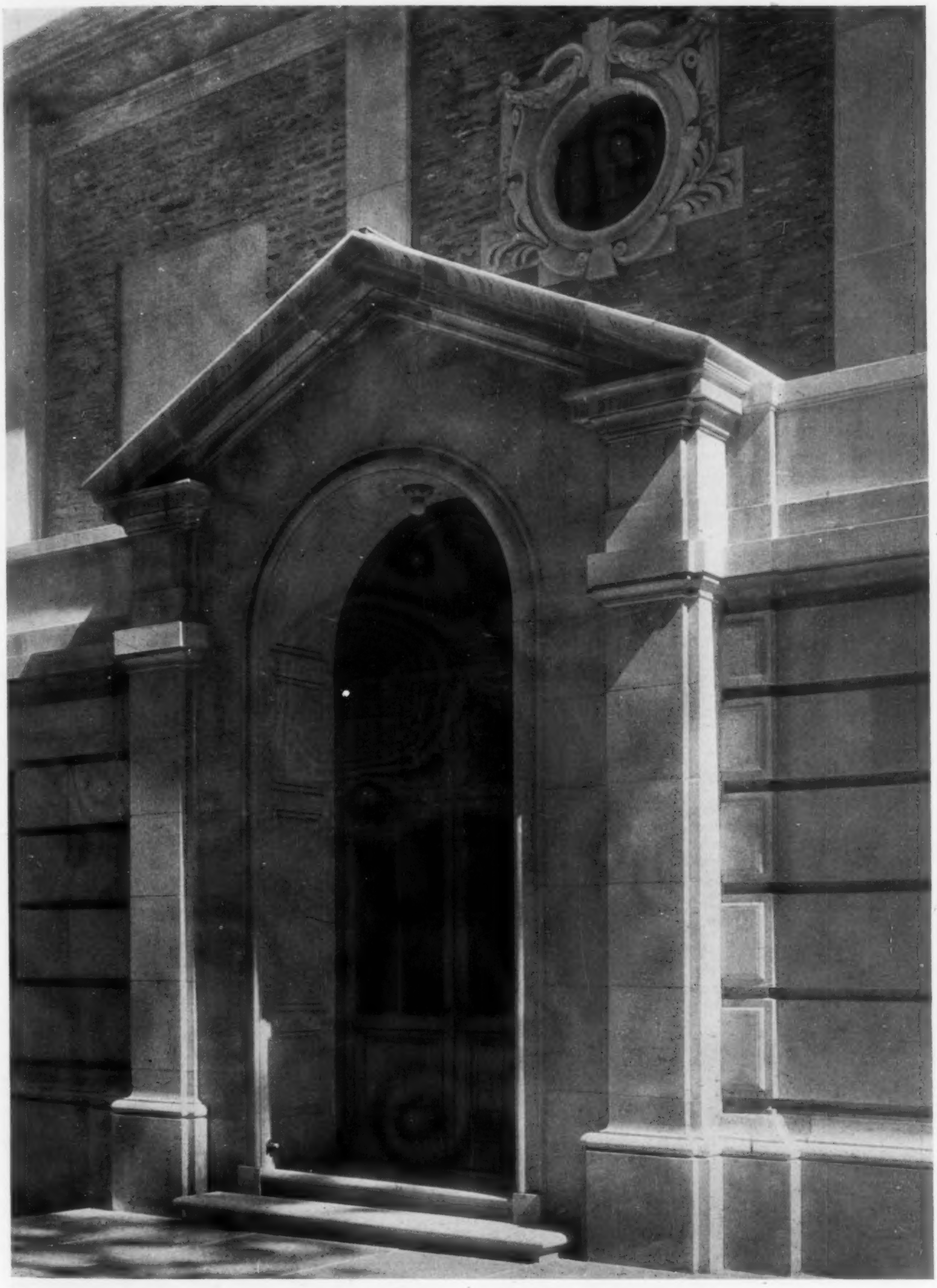
In harmonious furtherance of the color treatment, we may look to the east window. It is, indeed, with its glowing reds and blues, the very focus and climax of a consistent color plan. This memorial window, a work of great beauty, vindicating the ability of the modern glass craftsman, is an admirable conception designed and executed by Niccolo d'Ascenzo. Its source of inspiration was one of those rarely graceful Renaissance windows in the Certosa at Val d'Ema, just outside of Florence; nothing could be more appropriate or thoroughly in agreement with every feature of a building in which the best late Renaissance tradition is so happily embodied. No one will be disposed to cavil at the presence in the south transept of the painted window with Gothic tracery and stained glass, or the two stained glass lancet windows in the clerestory wall of the same transept. They are memorials brought from the former edifice.



Tower and Entrance from the South



DETAIL OF TOWER
CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT



DETAIL SOUTH ENTRANCE TO NARTHEX
CHURCH OF THE UNITARIAN SOCIETY OF GERMANTOWN, PA.
EDMUND B. GILCHRIST, ARCHITECT

Besides being filled with very good glass, they carry definite and strong associations, not only for the donors, but for the whole congregation, and it is eminently proper that those associations should be treated with all respect and honor. Though of a mode wholly different from that of the structure, they have been incorporated in a manner to which no one could reasonably take exception.

The one thing that detracts from the otherwise perfect consistency of the interior is to be found in the memorial glass set with unvarying monotony in all the clerestory windows. Such windows, at best, are an anomaly in a structure of this sort where clear glass should unquestionably have been used in all the windows, save in some one such isolated and focal feature as the east window, or the windows in the south transept, whose time-honored associations fully warrant their presence. Furthermore, the evanescent, poverty-stricken quality of these uniform memorials,—only a small portion in each is reserved for individual treatment,—suffers terribly by comparison with the distinguished beauty and excellence of the east window. It is only fair to say that the architect was in no wise responsible for this ill-advised aberration, and it is to be deplored that the church authorities either devised or countenanced it. It is idle to say that the objection is based solely on too literal a regard for precedent and tradition; it is justified by fundamental considerations of good taste.

A provision of the plan that will commend itself is the mode of entering the church. In good weather the congregation can mount the steps and go in by the main tower door; in bad weather people can enter more quickly the lower door, deposit their wraps and umbrellas in a cloak room, and then go up inside stairs to the lobby into which the tower door directly opens. Not the least agreeable feature of the group is the arrangement of the parish buildings around the cobble-paved courtyard on the north side of the church. Two items of the composition that are especially arresting are the paneled treatment above the windows of the main parish hall and the adaptation of the so-called Palladian motif above the entrance to the north transept. Throughout this part of the group, as well as elsewhere, there can be discovered a reticent and well studied commingling of details from both French and Italian sources.

The Chapel, the Priestley Library and the Parish Hall
Church of the Unitarian Society of Germantown, Pa.
Edmund B. Gilchrist, Architect

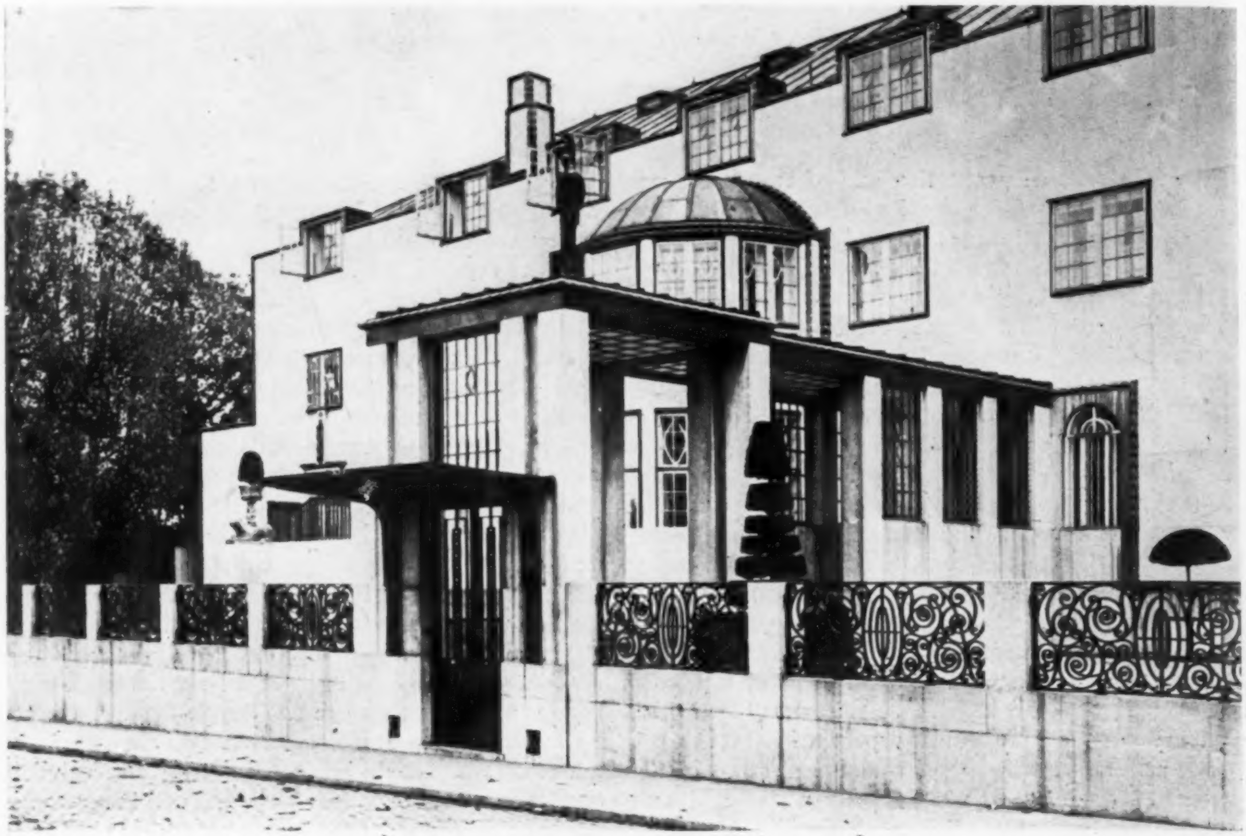
THE WORK OF JOSEF HOFFMANN

BY
SHEPARD VOGELGESANG

THE senses of proportion and of emphasis were unfamiliar. Criticism had been given in the atelier, and as much time as would be given designing a country house or a church had been spent on kindergarten primer illustrations in colored beads. The presence of kindergarten bead work in the same room with architecture, and the interest expended on the problem, illustrate a conception basic with Josef Hoffmann. To him the designing of a chair or a wine glass is a problem as important as the designing of an auditorium. In a sense it is the same problem; the design is to be appreciated in each case in relation to its destined human use, in relation to the material of which it is constructed, in relation to its æsthetic expression,—that is, proportion, rhythm, and color. All this is expressed in his work.

No recent architect has influenced Europe more comprehensively than Hoffmann. He was prominent in the group which in 1898 seceded from the Vienna Academy for the purpose of working, to give each object a logical, harmonious form, exactly adapted to the conditions of present life and expressed by perfect execution. This idea 27 years later was also the inspiration of the French Exposition des Arts Decoratifs,—it is at the heart of the best and the most progressive work in all Europe. The great Viennese architect, Otto Wagner, drawing upon the principles of the "Secession" as it was called, entered into his most creative period in 1900. Till the time of his death ten years ago he pushed the ideas of functional planning and expression of materials ever further toward the present-day goal. A pupil, then assistant with Wagner, Hoffmann carried these conceptions through architecture to the smallest object of daily use. The efforts of Morris and Ruskin to bring art again into contact with life, to revive craftsmanship, found in Vienna sympathy and intelligent interpretation. Hoffmann and Koloman Moser in 1903 founded the "Wiener Werkstatte" with the aim of providing a laboratory for the reanimation of craftsmanship and the understanding of materials which the machine had done much to destroy. The properties of materials can obviously best be learned by hand. After this knowledge is acquired, then can one design for and execute by machine without doing violence to the nature of the material. It is a precept of Hoffmann's that if one learns to do one craft well, one will know something of all crafts. One begins to understand what he means by "We do not dishonor tradition; we respect it." Europe was not slow in recognizing the work of Hoffmann and his associates. Repeatedly

Austrian Building at the Industrial Exhibition in Cologne, 1914



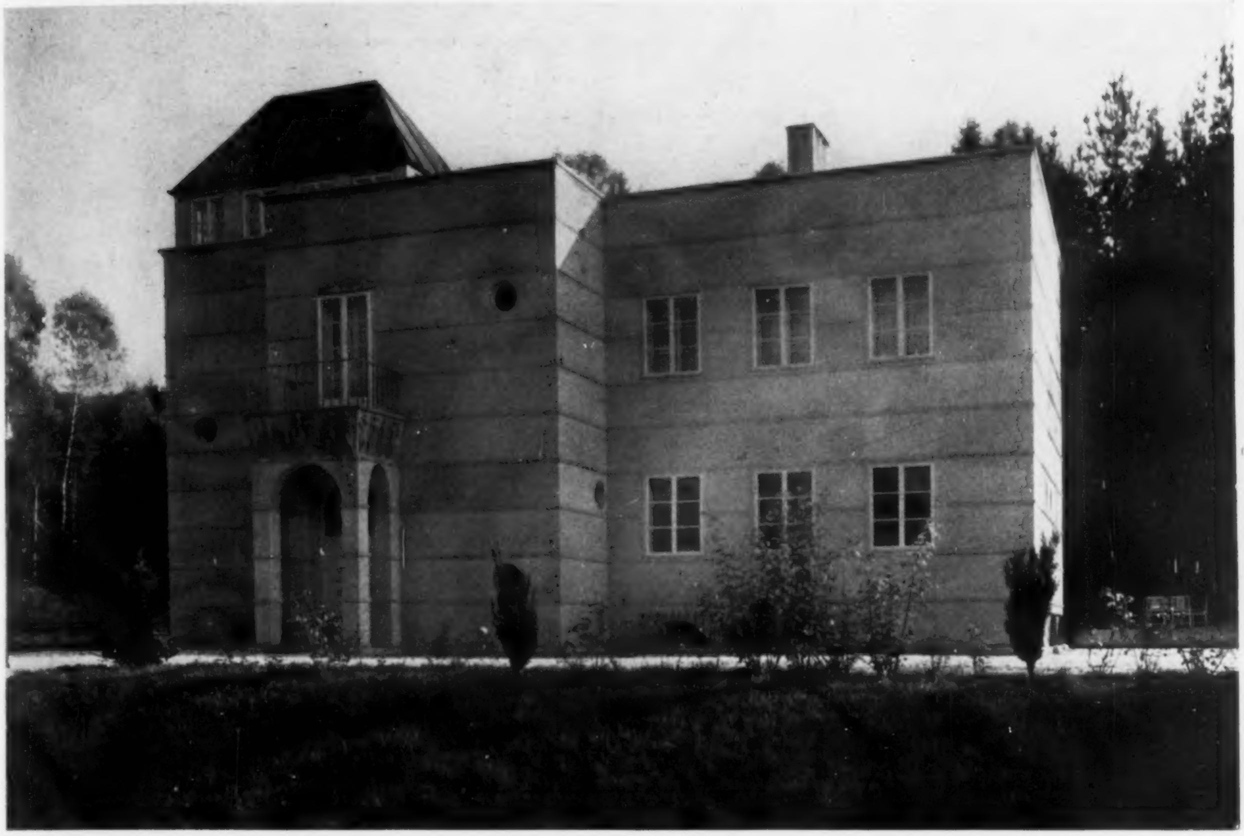
Entrance to the Palais Stoclet, Brussels (1905-11)

honored in his own country, degrees and decorations were early conferred on him by Germany and Italy, the French named him a "Chevalier de Legion d'Honneur" after the 1925 exhibition, and American architects, presently elected him to membership in their Institute.

With the sanatorium in Purkersdorf, built in 1904-1906, can be placed the Palais Stoclet in Brussels, 1905-11. Both were epochal buildings. At a time when Europe was scaling down the orders to decorate a villa, when architects began with a colonnade or a chateau to make a house for a clerk, Hoffmann conceived the Stoclet from the living requirements of its owners and created beauty out of proportion and his understanding of materials. It was the first of those houses, yearly increasingly numerous in Europe, where the life within builds its masses outward. Preceding the war, from 1911 to 1914, Hoffmann's building became more monumental, and he allowed his decorative sense greater play. There is in this work a continuous sense of quality,—the materials are understood; what is done is performed with largeness. The Austrian building at the Cologne Exposition and the Skywa house are typical of this period.

Garden of the Palais Stoclet, Brussels

Primarily a sequestered, luxurious villa, the Skywa house expresses much of the dignified extravagance of pre-war Vienna. The measured rhythms of its mass are an echo of a leisurely, luxurious life. It is not a building destined to make history in architecture, as is the palace of Baron Stoclet. Function is not given the master hand, but it is an original creation, suavely expressing the life of its time. Hoffmann evolved much of the decoration from his earlier influences,—here the archaic Greek is paramount. There is not a motif nor a treatment which can be traced to definite precedent; everything has been transmuted; only the feeling of the originals remains. In the same way that Hoffmann called Klimt from easel painting to mural decorating in the Stoclet house he brought Anton Hanak from the sculptor's studio to the builder's scaffold to decorate the Skywa house. The conceptions of workmanship which began in the "Secession" are continued here.



ENTRANCE FRONT

STAIR HALL

BEDROOM

HOUSE OF BAURAT E. AST, ESQ., VIENNA (1925)

JOSEF HOFFMANN, ARCHITECT

LIVING ROOM-BEDROOM FOR A MUNICIPAL TENEMENT SHOWN AT THE EXPOSITION, "VIENNA AND THE VIENNESE"

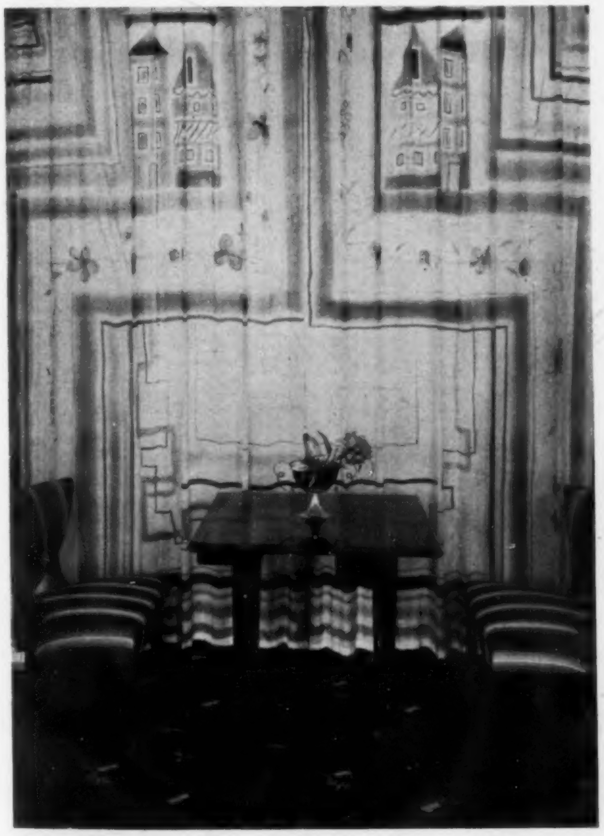
NURSERY APARTMENT

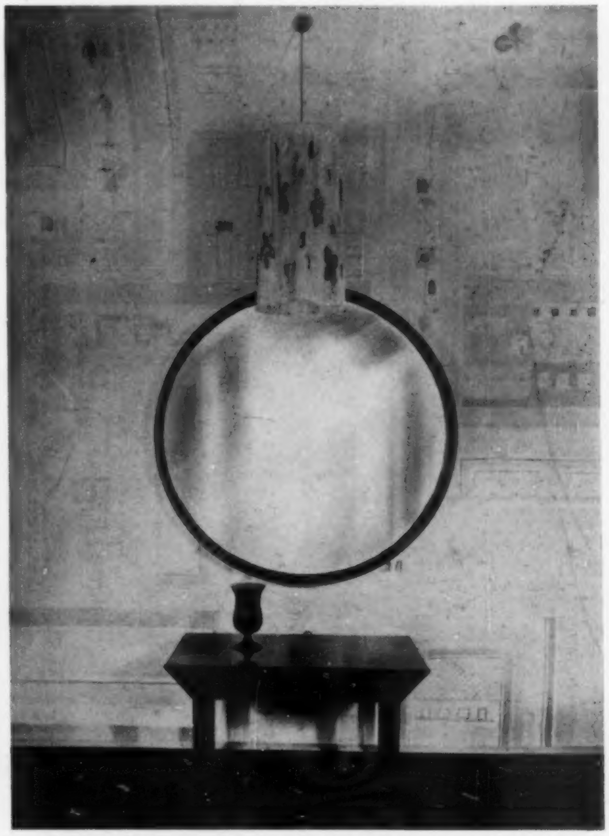
STOVE AND CHILD'S BED

INTERIORS OF BAUER APARTMENT, VIENNA (1927)

JOSEF HOFFMANN, ARCHITECT

A CLOSET CONCEALS THE BED WHEN NOT IN USE

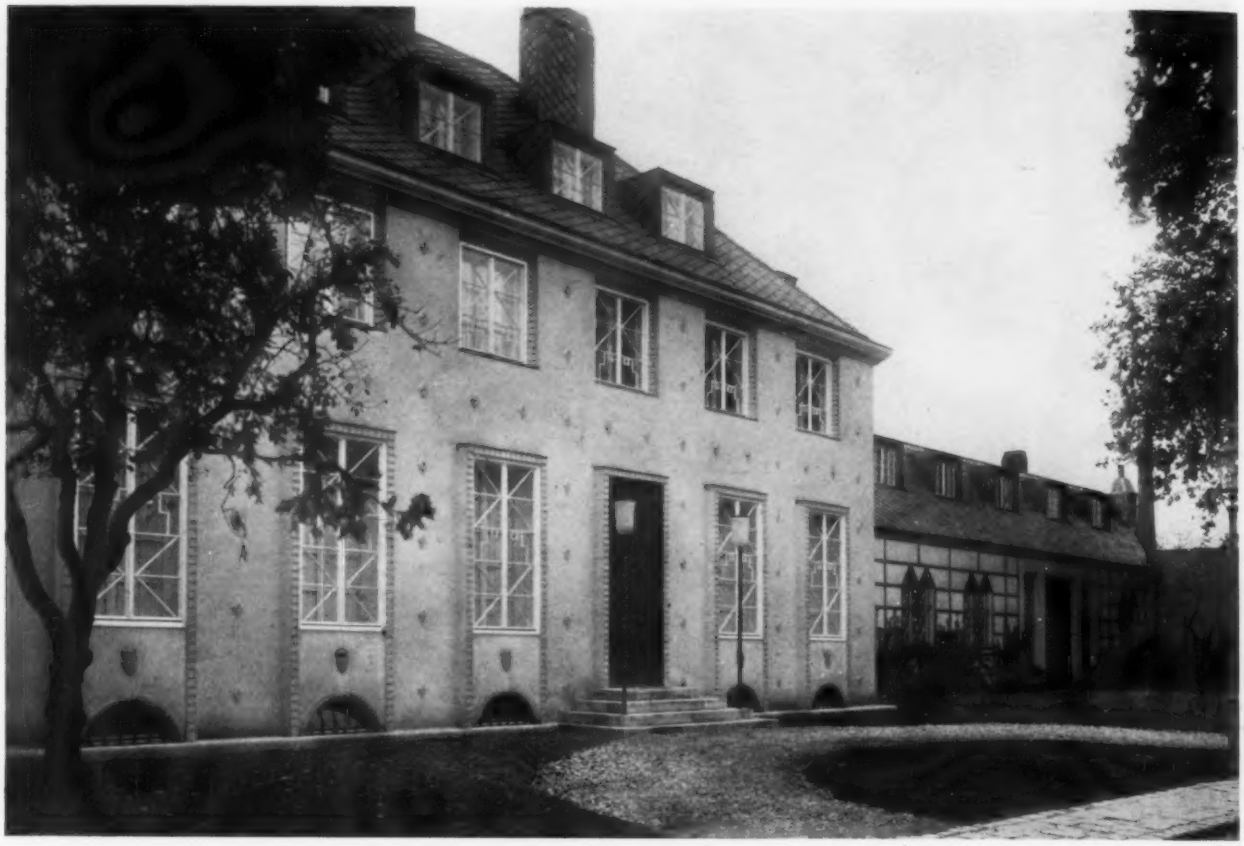




THE CARPET IS BLACK, STREWN WITH COLORFUL LEAVES AND FLOWERS; THE WALL PAINTING IN PALE YELLOWS AND PASTEL COLORS BY FRAU MARIA LIKARZ-STRAUSS

BEDROOM-LIVING ROOM, IN THE BAUER APARTMENT, VIENNA (1927)

JOSEF HOFFMANN, ARCHITECT



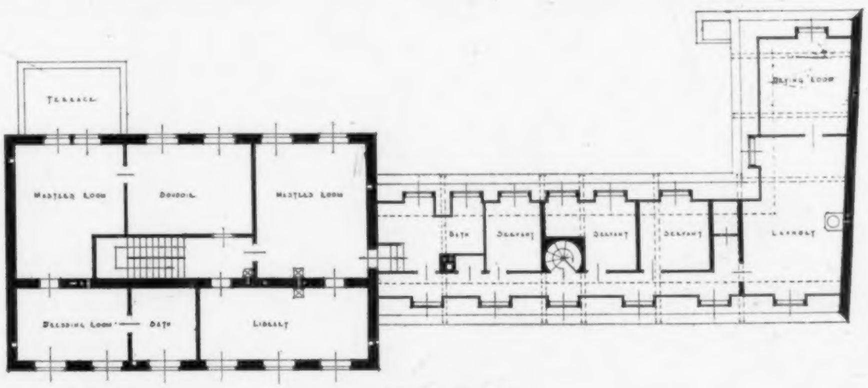
ENTRANCE FRONT

GARDEN TERRACE

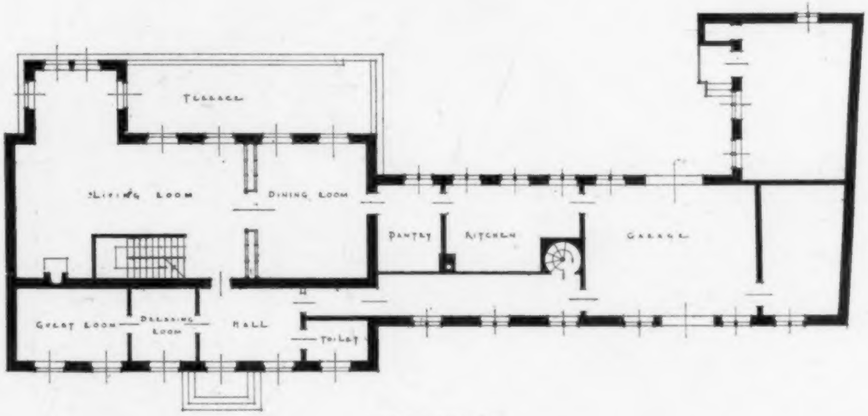
VILLA KNIPS, VIENNA, (1925)

JOSEF HOFFMANN, ARCHITECT

GARDEN FRONT

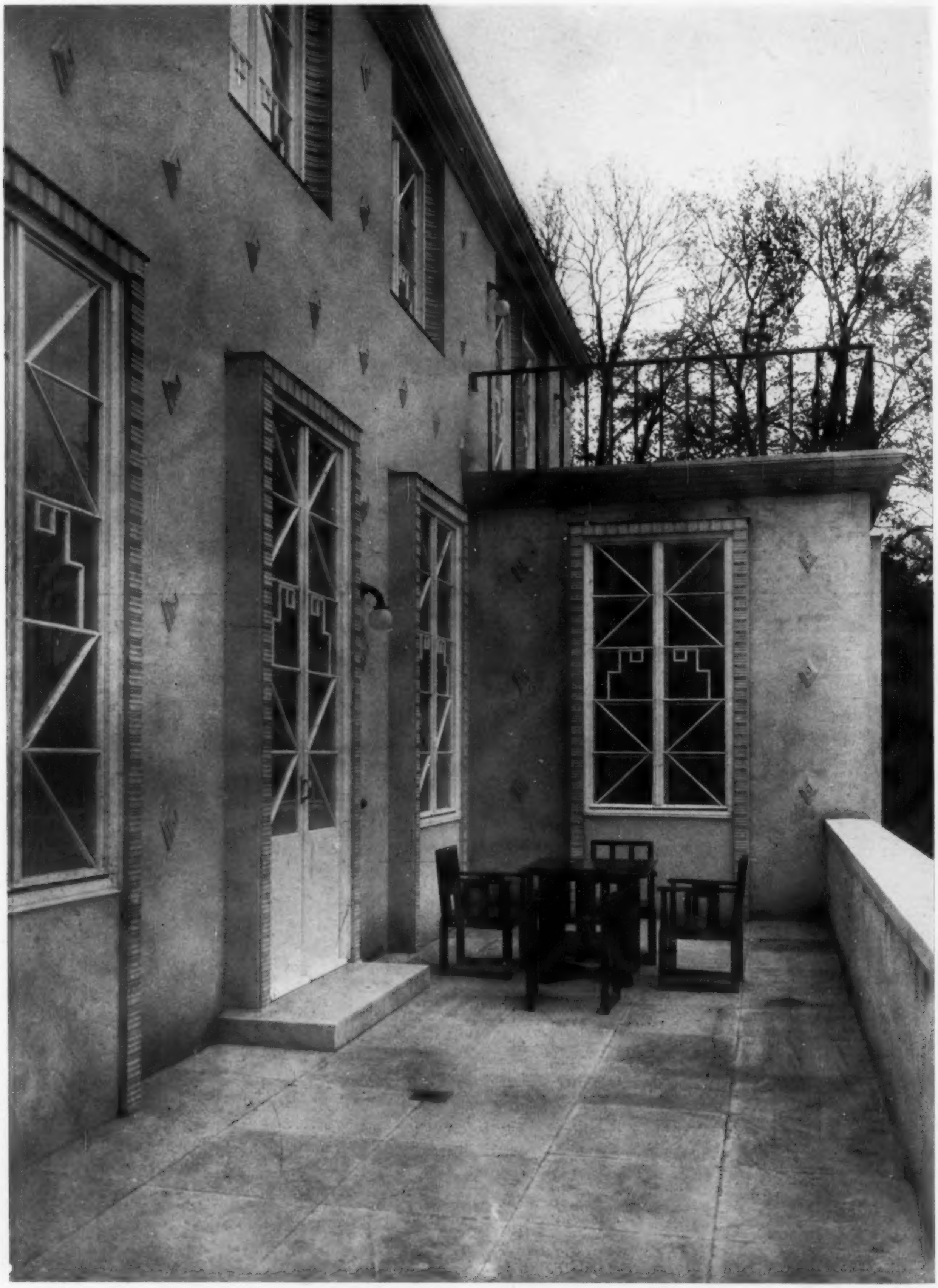


SECOND FLOOR



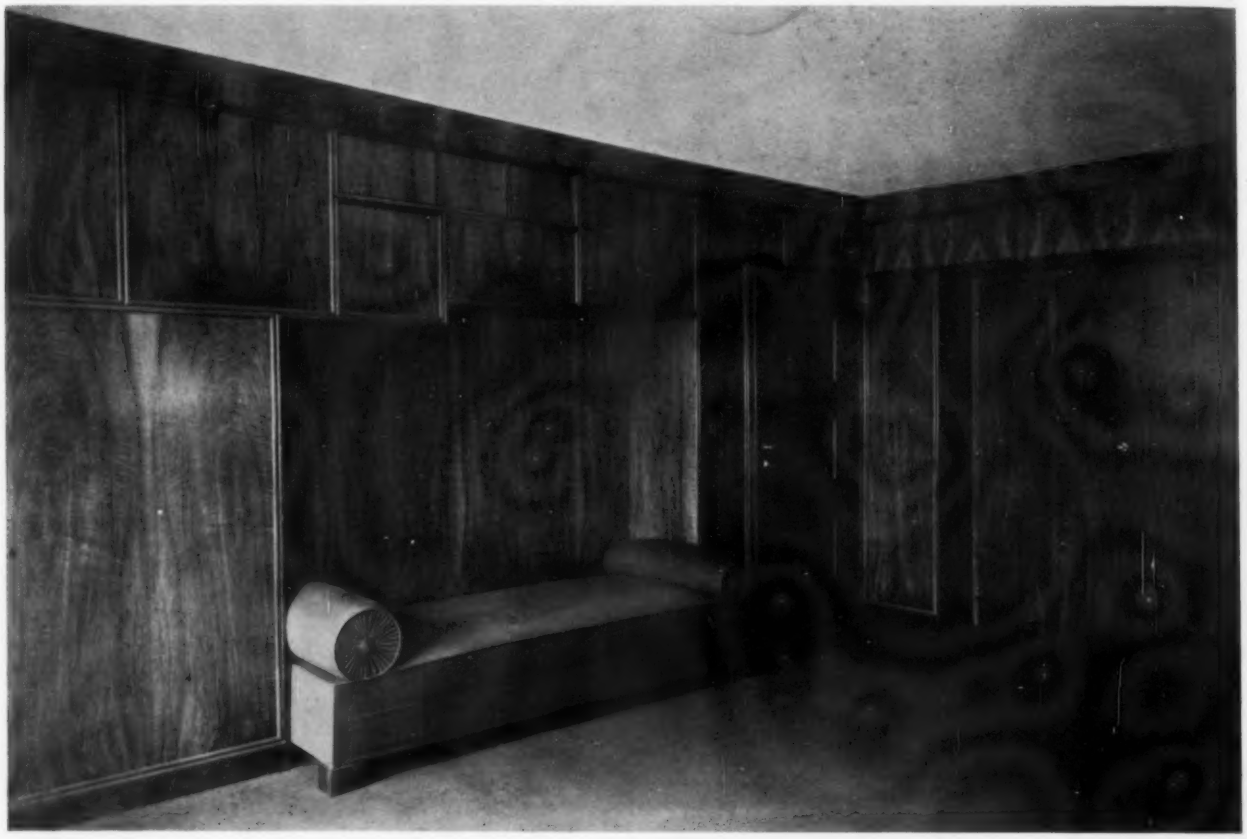
FIRST FLOOR

VILLA KNIPS, VIENNA (1925)
JOSEF HOFFMANN, ARCHITECT



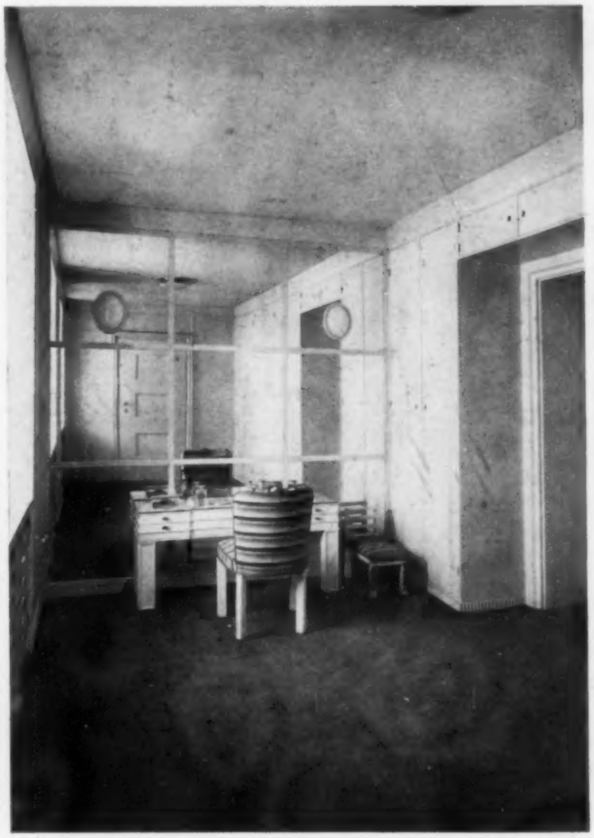
DETAIL OF THE TERRACE, VILLA KNIPS, VIENNA
JOSEF HOFFMANN, ARCHITECT

STEPS AND TERRACE WALL, VILLA KNIPS, VIENNA
JOSEF HOFFMANN, ARCHITECT

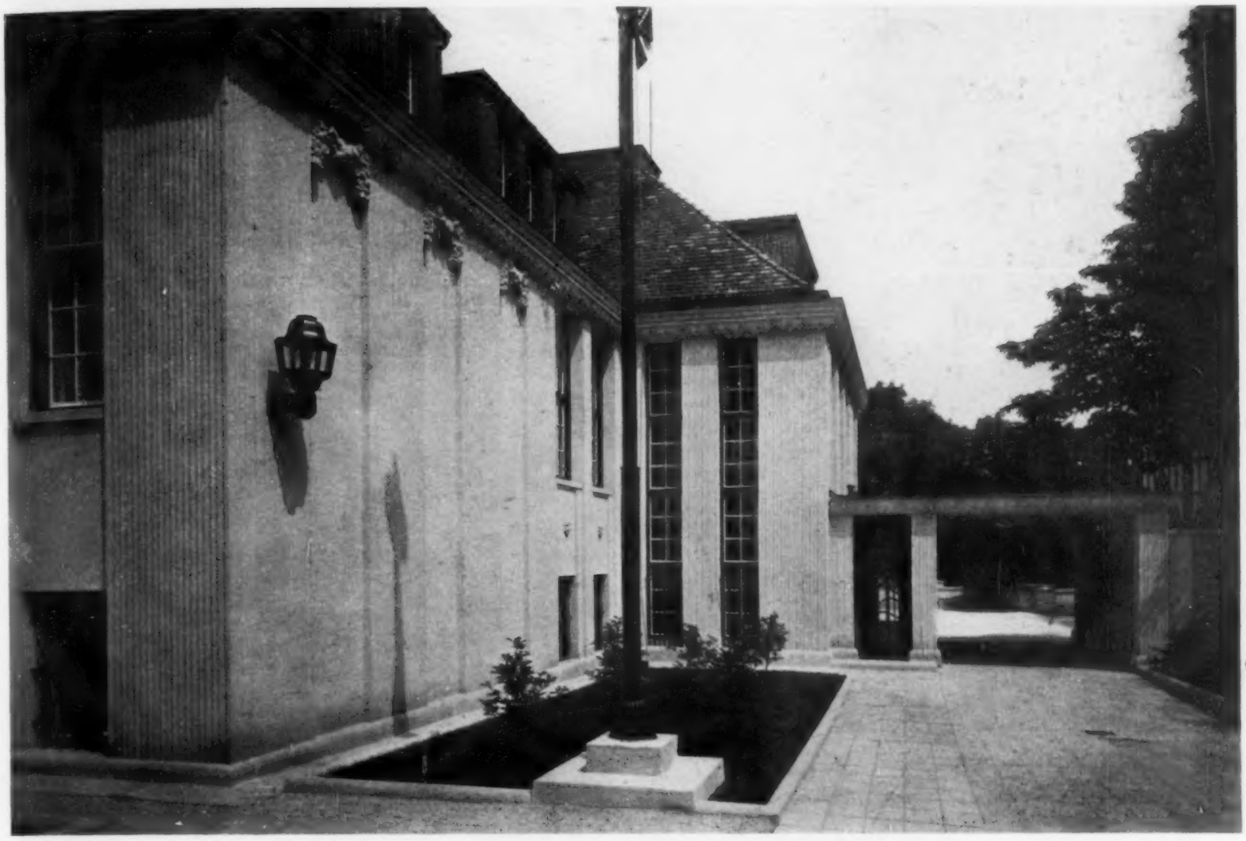


THE WALNUT PANELED BEDROOM

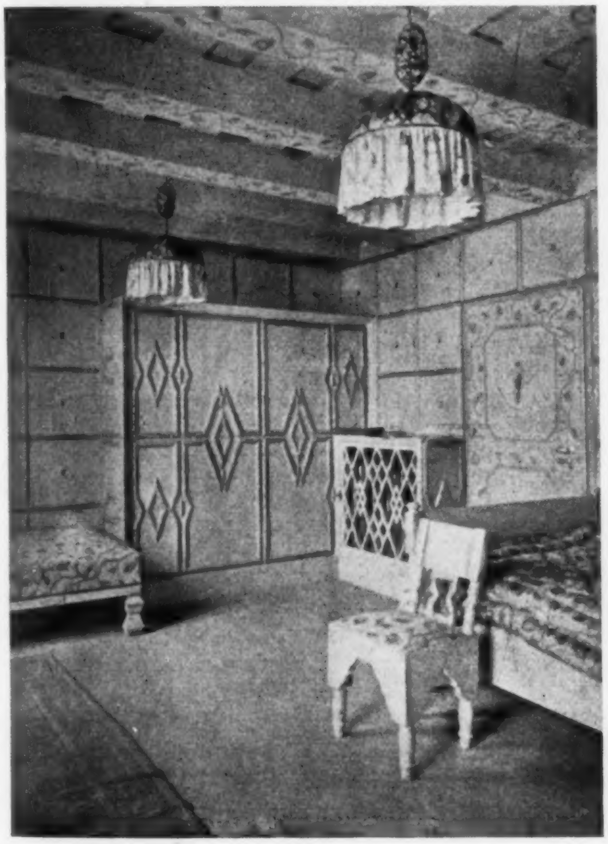
BLACK AND WHITE ENTRANCE HALL



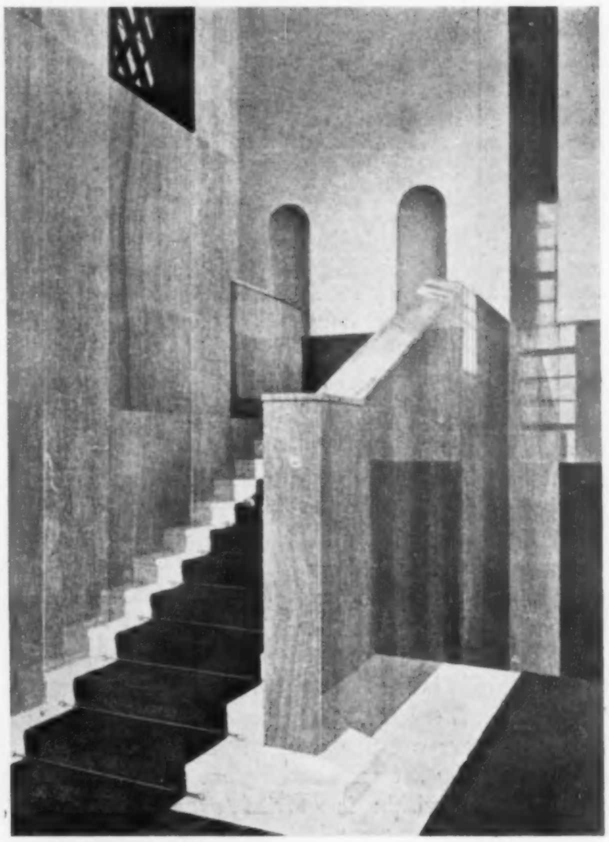
MME. KNIPS' BLUE BOUDOIR



ENTRANCE FRONT AND DRIVEWAY, VILLA SKYWA, VIENNA
JOSEF HOFFMANN, ARCHITECT



BEDROOM IN A COUNTRY HOUSE

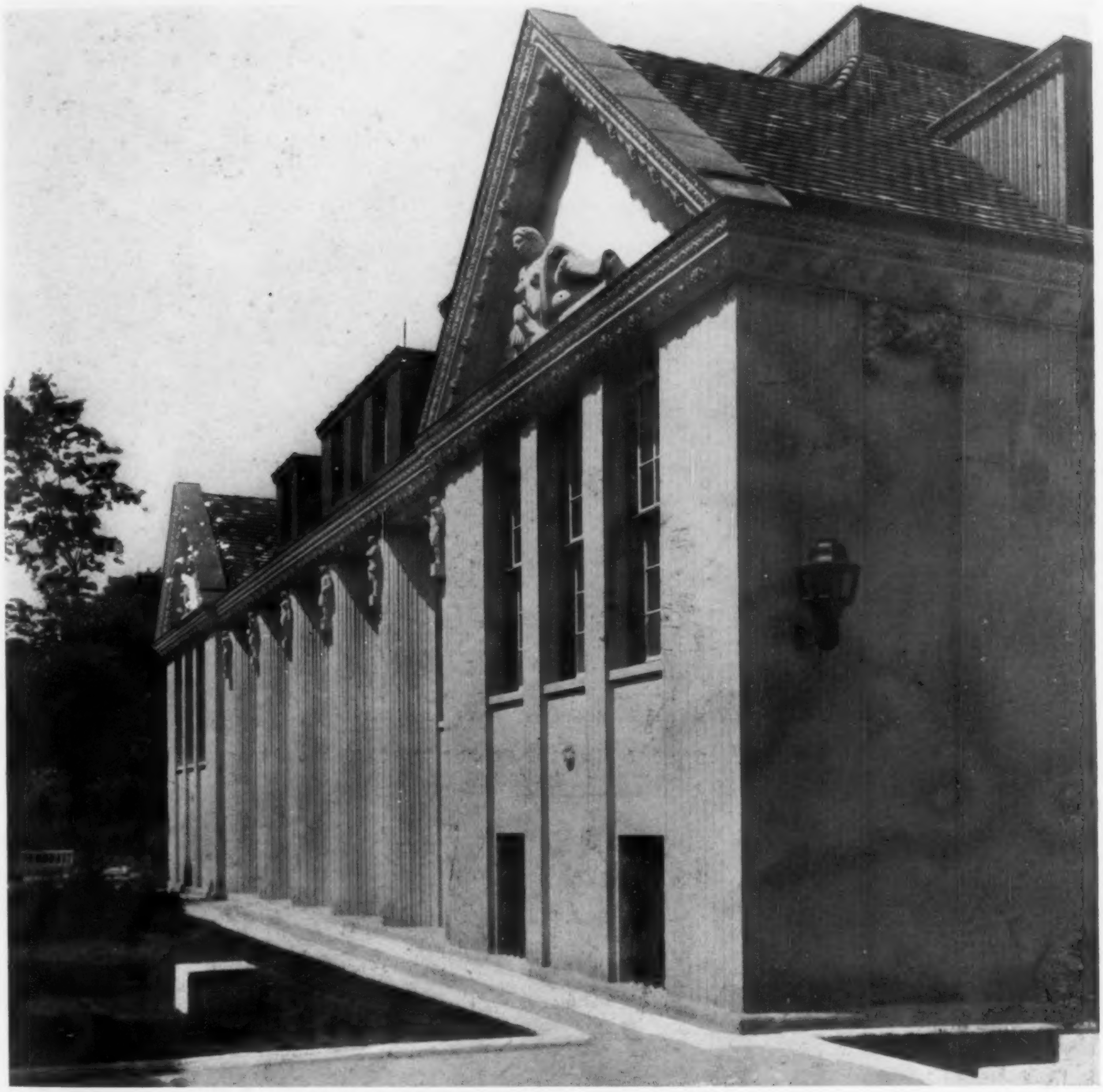


STAIR HALL IN MODERN STYLE

Forecourt of Villa Skywa, Vienna (1914)

The value which sound craftmanship can contribute to architecture is readily seen in this house. If there is a somewhat "bravado" permanence in its monumental quality, that assurance of permanence was also part of life in Vienna before the war. Since 1918 the Viennese have experienced the hardest realities of life. Building, where there has been opportunity to build, as well as life, has been forced away from luxury back to the primarily practical. More of Hoffmann's earlier reliance on function is to be found in his post-war work. In the Ast country house built in 1925, there is free expression of the interior arrangement. The house possesses quiet dignity with its informality of plan. The perfection of execution within is carried even into the tea service on the pantry table, the hooks on the wall, and the hardware on the doors. These things, when the finishing of a house is reached, are of importance.

To Americans the Villa Knips (1925-6) seems vaguely familiar. As with the Greek feeling of the Skywa house, so again with the Knips house one feels an influence rather than sees it. The plan is such a personal conception of the owner's needs that there is nothing one knows definitely like it. The guest rooms off the main entrance hall; the master's library accessible from his bedroom on the second floor, because he is a late reader; his wife's suite adjoining, and the attic nursery, are all distinctly an outgrowth of one family's mode of living, which would not suit other individuals. The living room and dining room are separated by a glass partition, thus giving to a small house the maximum sense of

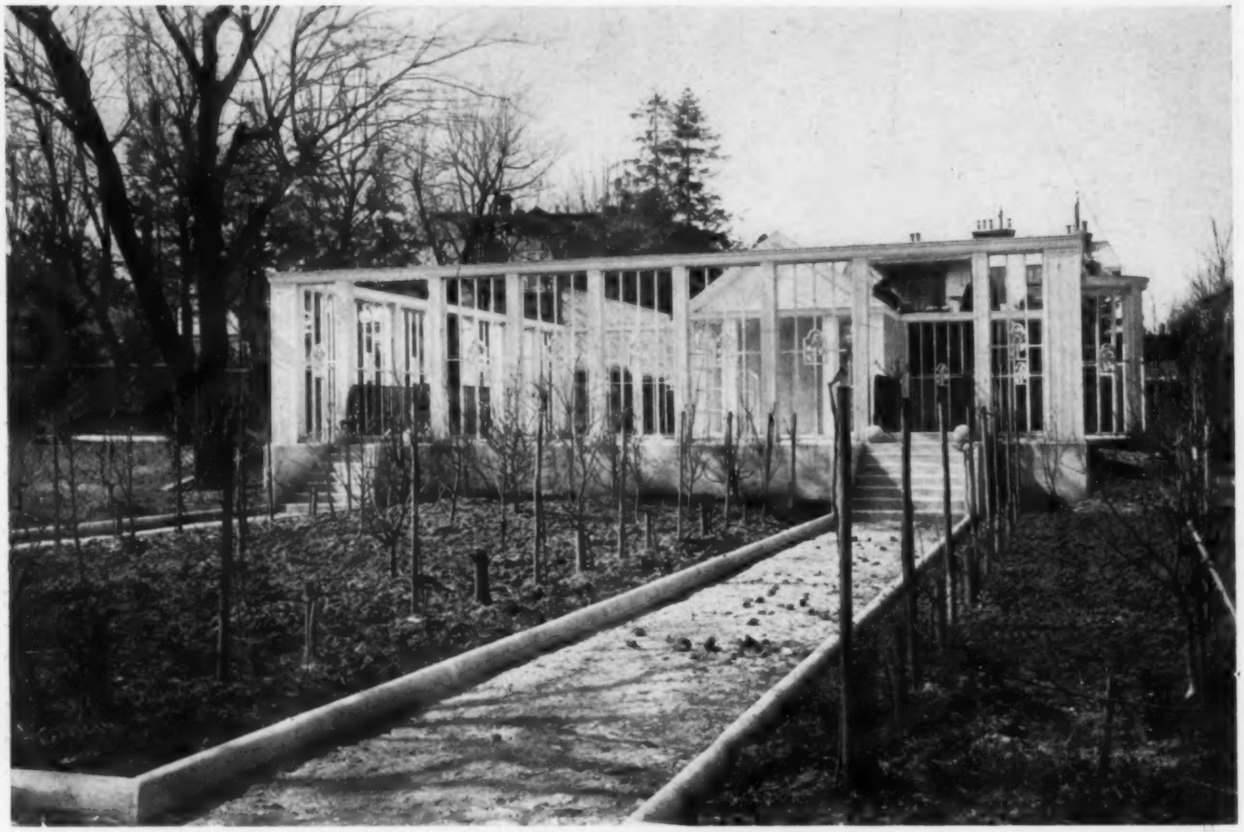


Garden Front, Villa Skywa, Vienna

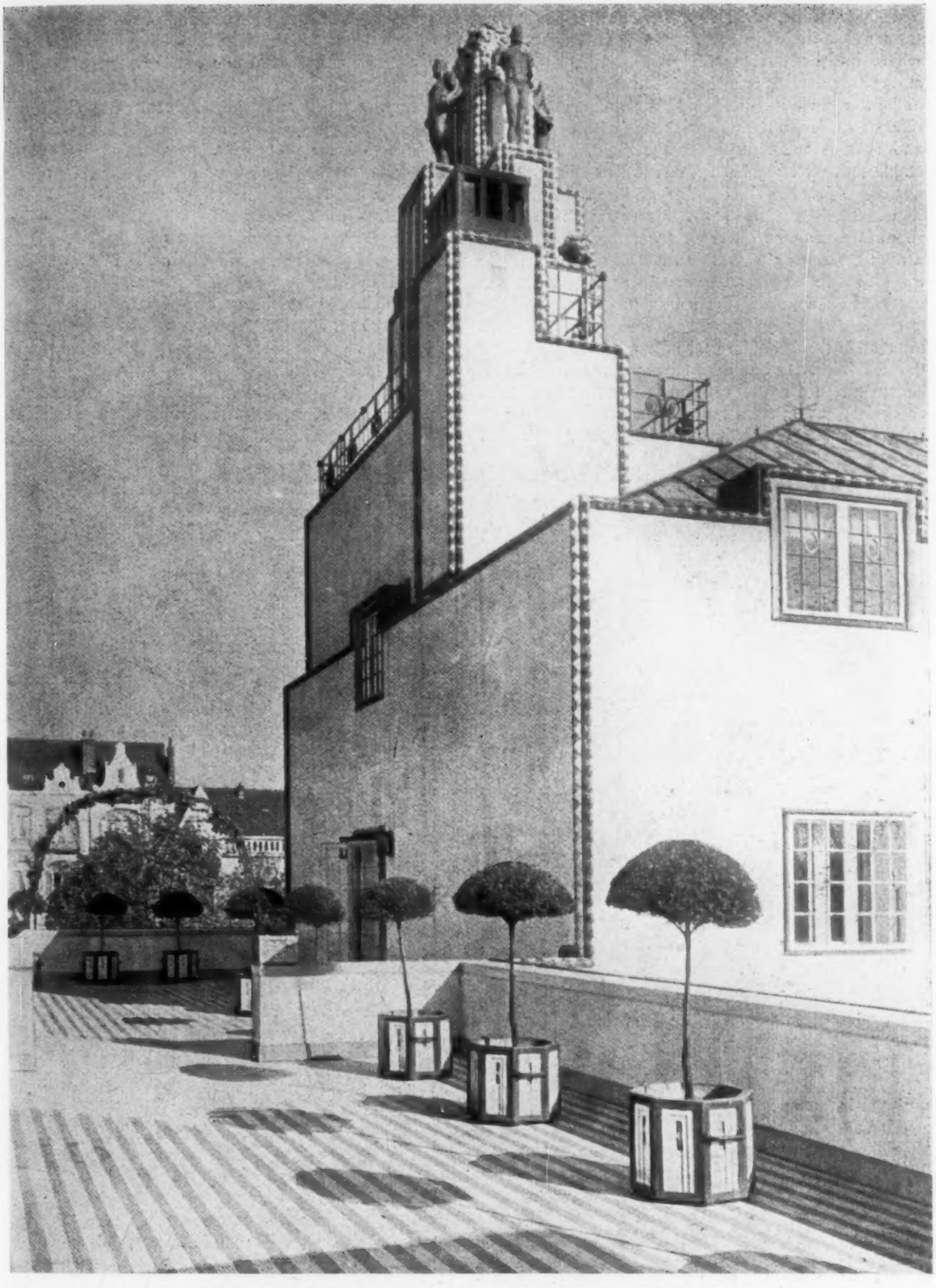
interior space. The "T" shape of the living room provides relief from the boxed-in feeling given by four walls. There is place for one's various moods all in the same room;—the sunny window end overlooking the garden, the retirement of the fireplace at the other extremity of the "T" branch, and the more formal portion represented by the stem of the "T" where one can receive acquaintances without entirely admitting them to the intimacies of hearth and garden. It is odd to find a feature in this house very typical of an arrangement much used in our most northern older states but seldom repeated in present-day design,—namely, the inclusion of the garage in the service portion of the house joined to the main part of the house by a corridor. Just such an arrangement was customary in New Hampshire and Vermont less than a century ago, where stables almost invariably connected indoors with the house. So little used is this feature at present that the probability that Hoffmann reached this solution entirely independently is almost a certainty.

The apartment which Hoffmann executed for Bauer is a product of the post-war economic condition of Vienna. The state is doing much to give the laboring class inexpensive housing; other classes make difficult shift for themselves. Room was limited; it was desirable to maintain a sense of quality throughout. The number of objects was kept to the essential, and the materials used were of the best,—nut wood for the furniture, and the walls and curtains are fine hand work. The use of folding beds, which economize space, is frank, and provision is made for

TENNIS BUILDING, GARDENS OF THE VILLA SKYWA, VIENNA



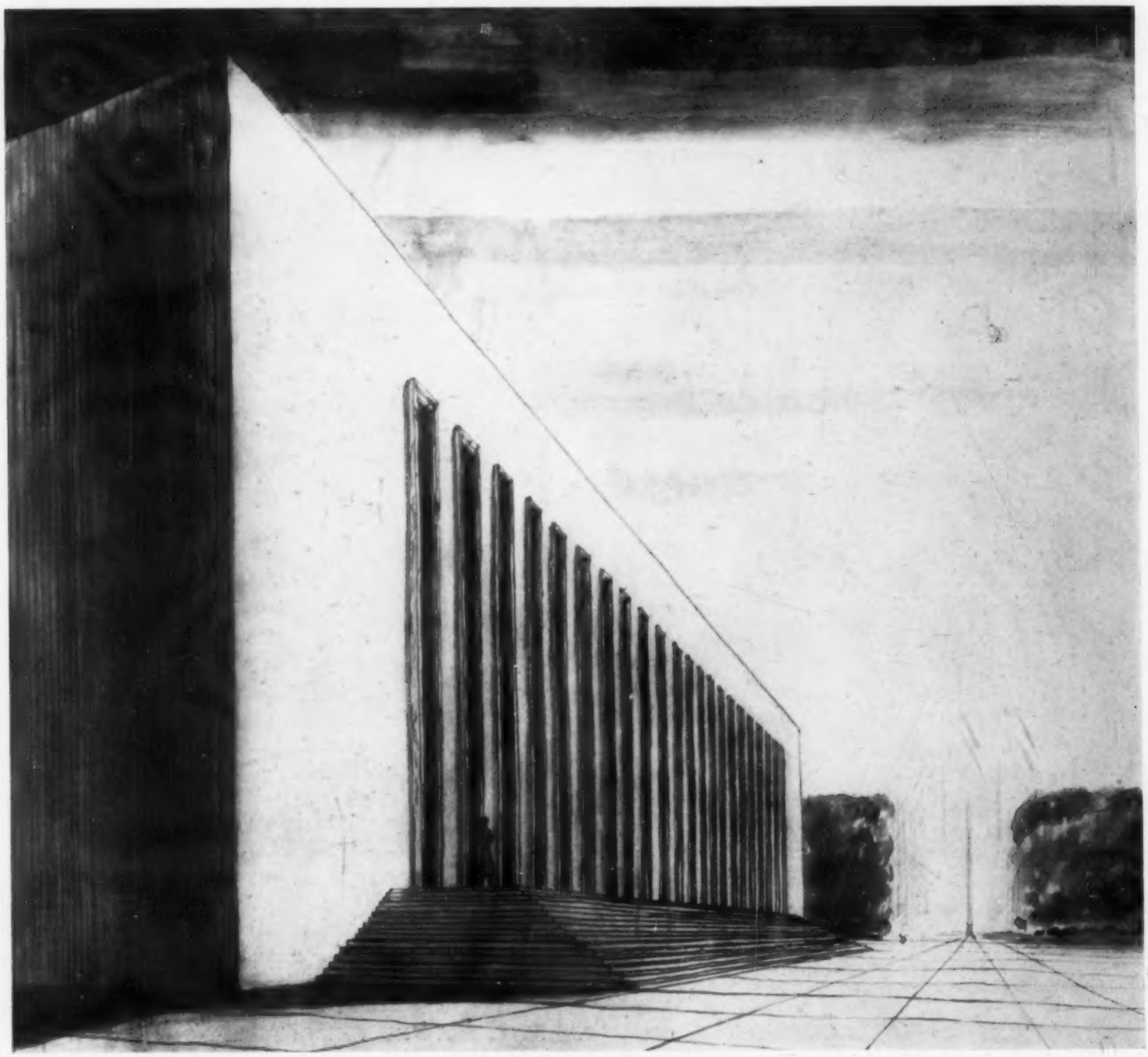
GARDEN HOUSE AND TERRACE, VILLA SKYWA, VIENNA



TERRACE AND TOWER, PALAIS STOCLET, BRUSSELS (1905)
VENEERED IN WHITE SWEDISH MARBLE, BOUND AT THE CORNERS WITH BRONZE
JOSEF HOFFMANN, ARCHITECT

ventilating them, when closed. A pull of the curtain does much to bring the needed change in a room where one both sleeps and lives. The baseboards and ceiling moulds are designed to facilitate cleaning, and the rounded character of the nursery furniture offers a buffer to the wear and tear of a rough-house and softens the bumps for the child. Too much emphasis may have been given the physical, human needs;—there are besides psychological considerations. Designing the paper for the wall of a bedroom is a problem different from the decoration of a dining room or a hall. In a Catholic church one can afford to suppress the structural emphasis. The cross and statues of the saints are there, and the question of their support in the structure is of small interest to the beholder; all is less a matter of logic than of faith. If one designs for children, it should be remembered that repetition is just that to a child. A design for a child's dress material repeating a bunny and a carrot, is just so many spots, and might as well be polka dots for him. Older people can concentrate on the maze, pick out the bunny and the carrot, and conceive of the phenomenon of a child completely covered with bunnies and carrots.

A plan of the auditorium, a recent competition design, is unfortunately not available. The perspective, however, gives a sense of what Hoffmann means by simplicity, by the sufficiency of doing one thing once. Here the one thing is rhythm, the sort of design which was architecture before a building was tied in a knot about a cartouche. Hoffmann's æsthetic teaching is almost summed up in the ideas of proportion and rhythm. Artistic expression is to be found within these limits, and it is guided toward simplicity and clarity. America is beginning to feel the influence of the modern spirit. There is a great deal of talk about the "modernism" of the world. The best that can be done, if one is given the chance, is to be keenly and clearly contemporary,—but it requires real genius if the result is to be successful.



Perspective Sketch for Concert Auditorium (1927)
Josef Hoffmann, Architect

INTERIOR ARCHITECTURE

EXHIBITION MODERNISM VERSUS HOME MODERNISM

BY

LUCIAN BERNHARD

MOST people know the so-called "modernistic" interior only from exhibitions or perhaps from the *mis en scene* of a night club. Whenever one happens to listen to the comments of visitors at such an exhibition, one hears: "Quite interesting, but I could not live in such a room."

In countries where the modern style has already been adopted and developed in many private houses, one will always find a great difference between the appearance of a home where people actually live and an exhibition room designed by the same artist. The necessity for this difference is quite obvious. An exhibition of interiors to be interesting must be radical and dramatic. It has to emphasize the departure from tradition rather than the relationship to past precedent. It must be stunning; it has to show up a new idea in full strength and without compromise. As no one lives there, no consideration in regard to restfulness is necessary, and none to comfort, subdued colors, wear and tear and practicability of the furniture. It is a demonstration of an idea and nothing else. Not even the designer himself, according to my experience, would care to live in such rooms. These characteristics hold true not only for exhibitions but for the decoration of night clubs, foyers of theaters, interiors of steamers, hotels, show rooms and beauty parlors. Here people do not actually live. They need endure these surroundings for only a short period of time. People who frequent night clubs want to be exhilarated. They are seeking stimulation and exciting atmosphere. Nothing can serve them better than the many possibilities offered by the abandonment and extreme of some modern creations. All the wild exaggerations and brain storms of the turned-loose copyists contribute fantastically to the punch one is hoping to find in such places. We do not need to look at this too critically. It serves its purpose. The homes

Photos. Tebbs & Knell, Inc.

Living Rooms, Apartment at 791 Park Avenue, New York

Lucian Bernhard, Designer

AN ALCOVE WITH BUILT-IN BED

STAIRWAY IN CORNER OF ENTRANCE HALL

APARTMENT IN MODERN STYLE, 791 PARK AVENUE, NEW YORK

LUCIAN BERNHARD, DESIGNER

ENTRANCE TO THE LIBRARY

END OF LARGE LIVING ROOM

APARTMENT IN MODERN STYLE, 791 PARK AVENUE, NEW YORK

LUCIAN BERNHARD, DESIGNER

THE DINING ROOM HAS DEEP IVORY PAINTED WOODWORK, BLACK FRIEZE, GOLD CORNICE AND CEILING

EXTRA CHAIRS WHEN NOT IN USE FORM DECORATIVE BASE TO BUILT-IN SIDEBOARD

APARTMENT IN MODERN STYLE, 791 PARK AVENUE, NEW YORK

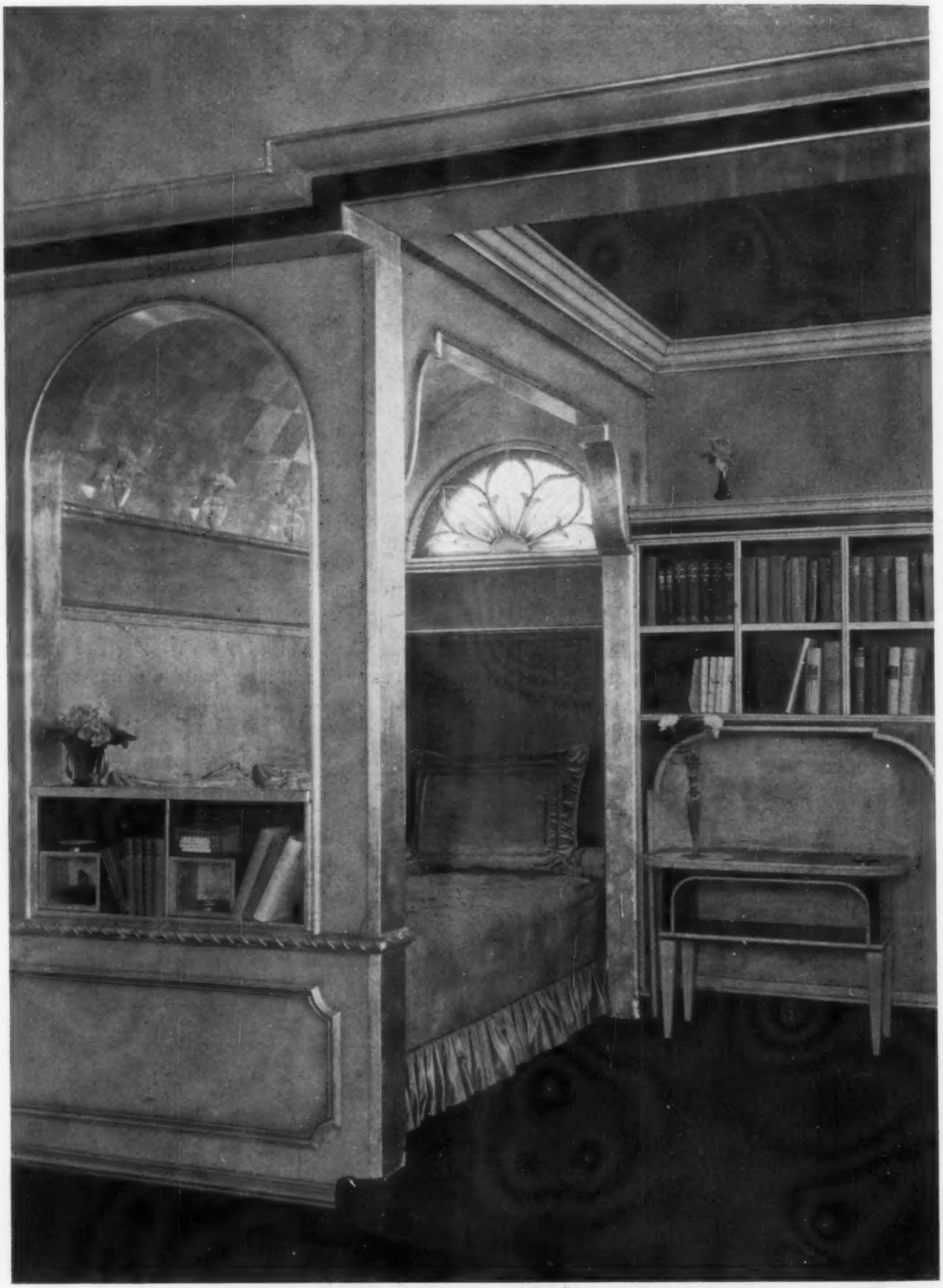
LUCIAN BERNHARD, DESIGNER

OLD GOLD, BLUE AND DEEP ROSE ARE SOME OF THE COLORS USED FOR THE CURTAINS AND UPHOLSTERY

BUILT-IN SEATS HAVE DRAWERS AT EACH END FOR PLAYING CARDS AND SCORE PADS

APARTMENT IN MODERN STYLE, 791 PARK AVENUE, NEW YORK

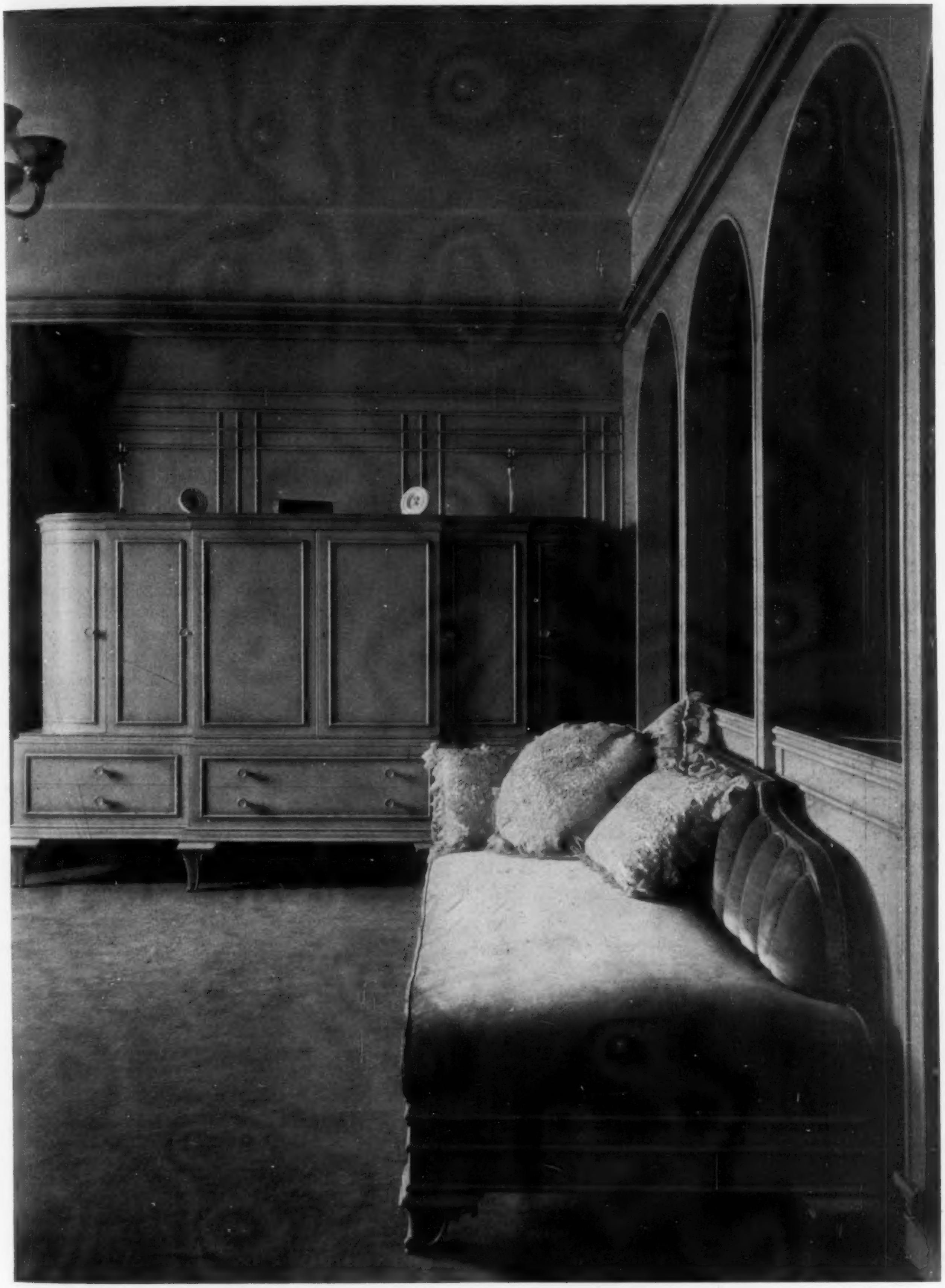
LUCIAN BERNHARD, DESIGNER



SPACE IS SAVED BY BUILDING IN THE BEDS AND BOOKCASES

APARTMENT IN MODERN STYLE, 791 PARK AVENUE, NEW YORK

LUCIAN BERNHARD, DESIGNER



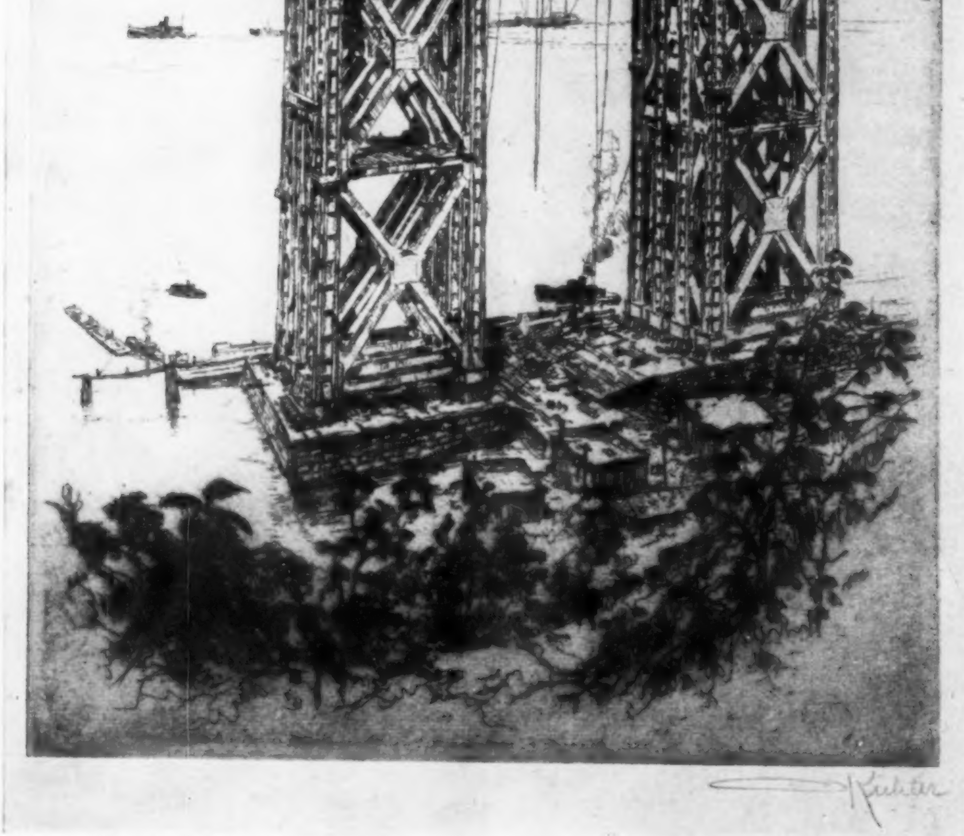
SIMPLICITY IN DETAIL AND BEAUTY OF COLOR CHARACTERIZE EVERY ROOM
APARTMENT IN MODERN STYLE, 791 PARK AVENUE, NEW YORK
LUCIAN BERNHARD, DESIGNER

where people live with their families, in contrast with exhibition, night clubs or show rooms, must be looked at from quite a different angle. A good interior cannot be the self expression of the artist; it must be a compromise between the self expression of the artist and the self expression of the owner. First, it is designed to please for a comparatively long time; second, it has to suit not only the gay hours but the sad moments; third; it has to be restful, intimate and comfortable; fourth, it has to please not only one member of the family, but all of them with their usual very different views of life. It must be remembered that comfort here is more important than style, and practicability more than effect. A less smart looking member of the family must not look ridiculous and be made to feel uncomfortable and out of place, as he certainly would in an ultra-modern exhibition setting. The rooms should not be exciting. We do not want them to cry out: "Look, how modern and clever we are." We want them to form an unobtrusive background for the average modern personality. Our present-day life is exciting enough. We want homes to have a quiet and restful atmosphere in which to relax.

While we do not want to live in masquerades of the past periods, while we do not want to imitate a Tudor library in a modern skyscraper apartment, while we do not want to use imitation candlesticks for our electric light fixtures, or sentimental bell ropes instead of push buttons any more than we want to imitate old carriages for our automobile bodies, and while we do not want to copy in our machine-made furniture non-essential lines, ornaments and peculiarities of past periods, such as early Renaissance chests with imitation worm holes to house our latest model radio, on the other hand we do not want to deny the perfection of a genuine old masterpiece or the æsthetic value of a beautiful room of the past based on human proportions which never change. The more we become sure of ourselves the more we will be unafraid and unashamed to acknowledge the great heritage bequeathed us by the masters of the past. We should be able to merge their best with our own and adapt it to our modern needs, mediums and methods without copying them thoughtlessly and slavishly. The more we feel sure of ourselves the more we will keep friends with tradition and extend hospitality to such fine old pieces as we may have inherited or collected or enjoyed. We want to be proud of our day and its achievements, but nevertheless we want to acknowledge all the wisdom and art of older generations as far as it still holds good for us and logically influences the art and architecture of our civilization. With all our achievements of modern form and color creations, the world would be very poor and empty if the work of the architects, painters and sculptors of the past should be blotted out forever.

Many of the European creative designers who started the revolution about 1900 have already outlived their radicalism for the sake of evolution. They are not afraid to incorporate with the essentials of the modern idea all the inspiration they can derive from admiring and understanding, not imitating, the masters of the past. The houses, steamers, clubs and shops designed by these artists may not yet be appreciated by the masses, but they are thoroughly liveable, well bred, a product of our times.

Reminiscent of the French Style is the Alcove Arrangement of the Beds in the Principal Bedrooms
Apartment in the Modern Style, 791 Park Avenue, New York
Lucian Bernhard, Designer



Courtesy Schwartz Galleries

HUDSON RIVER BRIDGE UNDER CONSTRUCTION

FROM AN ETCHING BY OTTO KUHLER

THE
ARCHITECTURAL
FORUM
VOLUME XLIX NUMBER FIVE
NOVEMBER 1928

THE DEVELOPMENT OF THE SUSPENSION BRIDGE

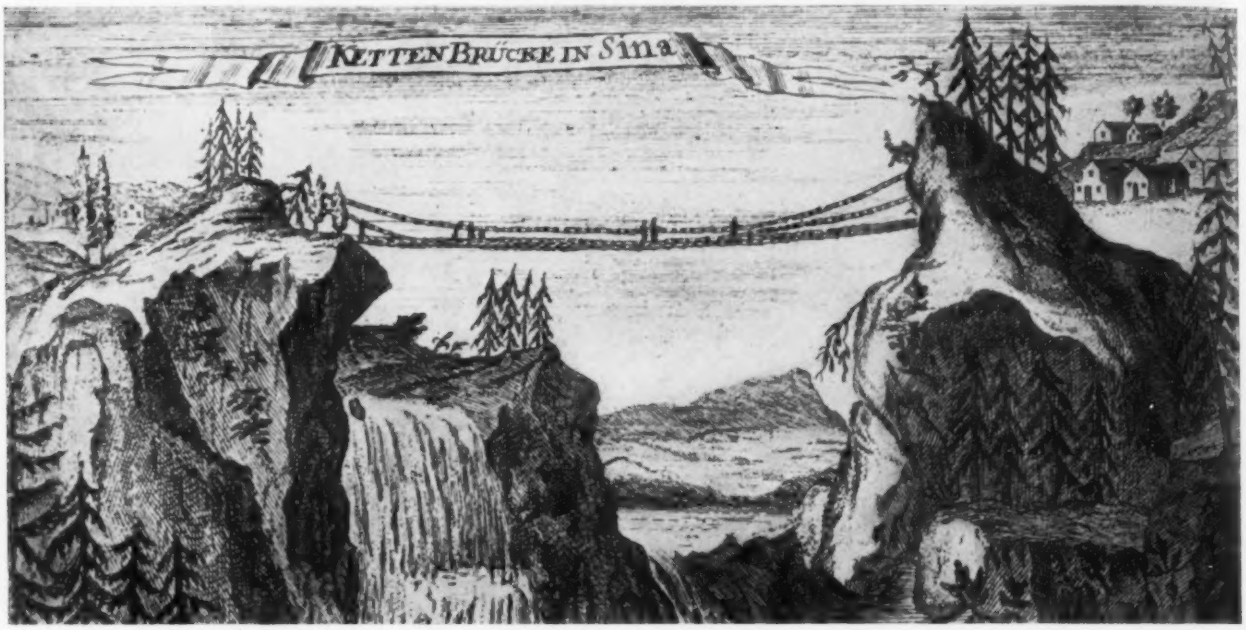
BY
CHARLES A. JOHNSON

THERE is something about a bridge that is inspiring and stirs the imagination. This is especially true of suspension bridges, with their light and graceful cables sweeping across spaces from one tower to another and supporting with their slender vertical cables avenues of progress. It is not known what inspired the first suspension bridge. It may have been a vine trailing from one tree to another that primitive man used to cross a ravine to save himself the labor of scrambling down and up the steep sides to get from one side to the other.

The first suspension bridge of which we have record was built in A.D. 65 in China, in the province of Yunnan, by order of Emperor Ming. It is described as being 330 feet long, with planks resting on the chains. All of the early suspension bridges were of this form, with the floors of the bridges following the catenary curves of the cables. Bridges of this type are found in China, India and other far-off parts of the world. The modern type of suspension bridge is an American invention, and its greatest development has been in this country. The suspension bridge is the oldest and most picturesque type of metal bridge. It is light and graceful; provides a roadway at low elevation with unobstructed view; has low center of wind pressure; dispenses with the use of falsework during construction; uses materials that are easily transported and erected and eliminate the danger of failure during erection. After completion, a suspension bridge is the safest structure known to bridge engineers.

James Finley, of Fayette County, Penn., built a suspension bridge of 70-foot span across Jacob Creek on the turnpike from Uniontown to Greensburg in 1796. The bridge was suspended from two iron chains, one on each side, the lengths of the links being governed by the distances between the suspended floor joists. The chains had a sag of 10 feet, or one-seventh of the span, were supported by masonry towers having the same angle of inclination on each side, and were anchored by large stones on shore. The suspended wood floor was 12½ feet wide without any stiffening truss, and the cost of the bridge was about $600. Finley obtained the first patent on this bridge from the United States government. Modern bridge engineers say that Finley's bridges were remarkably well designed structures for that time, and that he used sound principles of construction. The principal features of his invention consisted in the use of stone abutments, in the introduction of only two chains, one at each side of the bridge, and rigid floor construction. His chains were forged wrought iron links. Up to the year 1801, eight bridges had been built in the United States according to Finley's patent, and between 1801 and 1809 many others were built. The largest of these, the bridge across the Schuylkill at Philadelphia, was 306 feet long and was erected in 1809. This bridge had an intermediate pier with two spans of 153 feet each, and was the first suspension bridge with more than one span. The cables were made of long, iron links from which the floor was suspended by rods. It collapsed in 1811 under an excessive load of cattle, and was replaced by another suspension bridge which fell in January, 1816, under a load of ice and snow. The third bridge on this site was opened in June of the same year and had a single span of 408 feet with a foot-walk only 18 inches wide. This bridge was erected by White & Hazard, who owned and operated a wire mill in the vicinity, and the cables were composed of six ⅜-inch wires. The wood floor was without stiffening and would support only eight persons at a time. The cost was $125, and a toll of one cent was charged for each person. The outstanding feature of this structure was that it was the first wire suspension bridge ever erected in any country. It fell soon after its erection, under a load of snow and ice, and was replaced by a wooden bridge.

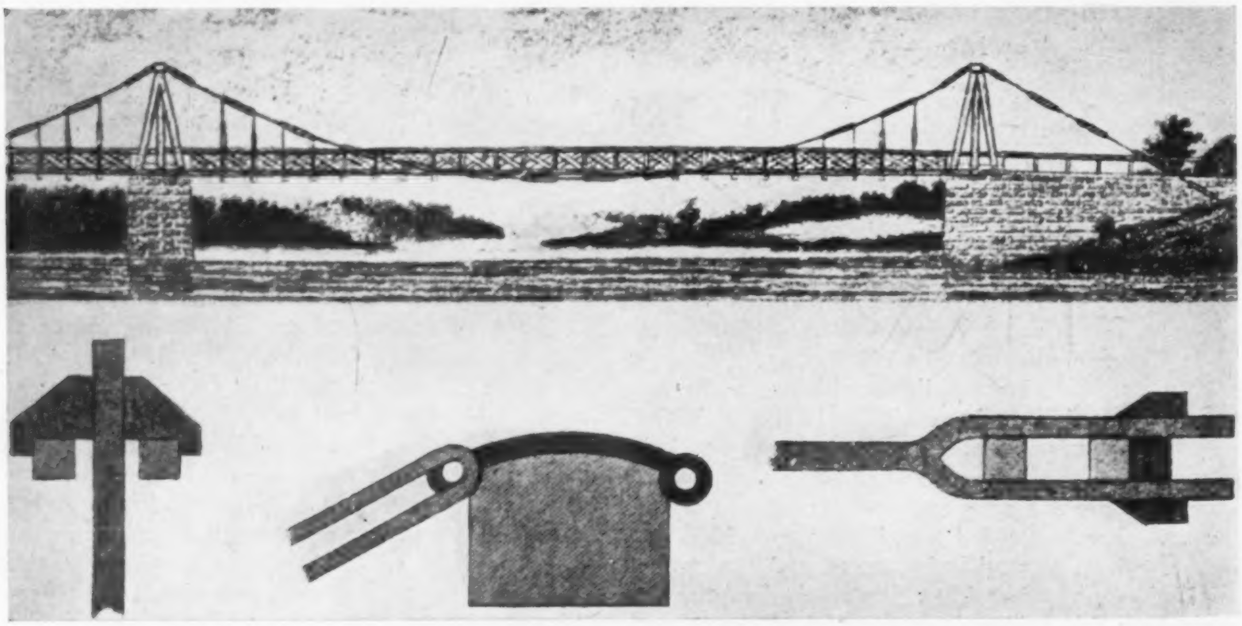
The most famous of the old chain bridges designed after Finley's patent was that across the Merrimac River, three miles from Newburyport, Mass., which was built in 1810. This bridge was built by John Templeman, of Washington. It had a span of 244 feet, a clearance of 40 feet above the water, and cost $25,000. The two roadways, each 15 feet wide, "were strong enough to allow for the passage of horses and carriages, whatever their speed. The railing was stout and strong, which contributed much to the stiffness of the floor." Each



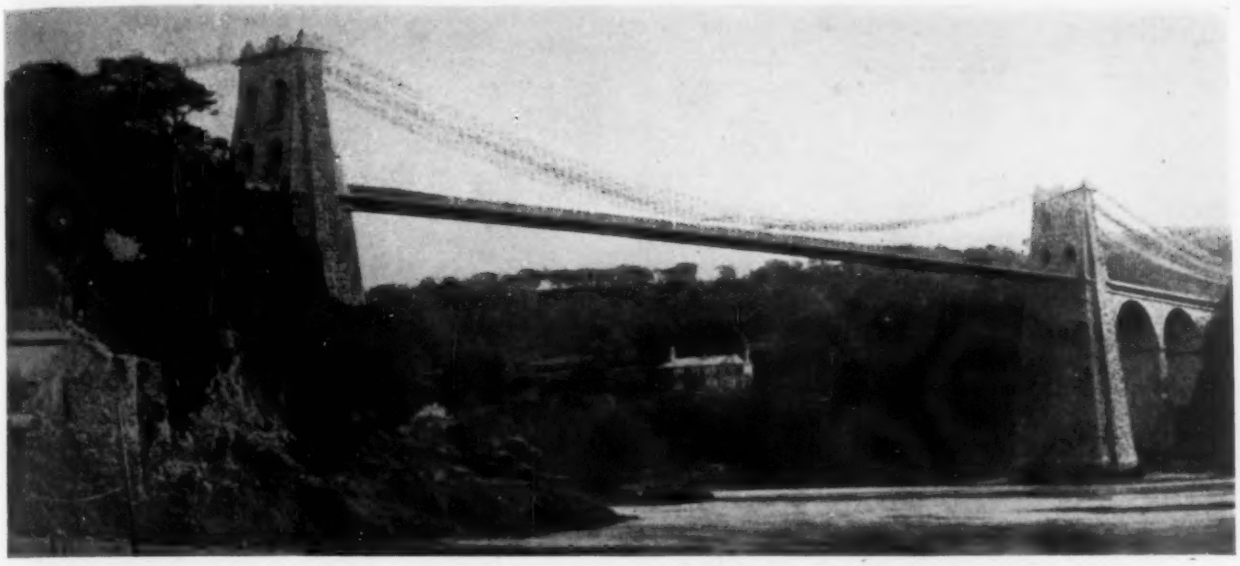
Suspension Bridge, Built A.D. 65 in the Province of Yunnan, China

roadway was supported by two sets of cables, each containing three chains, or a total of 12 chains for both roadways. The links were 27 inches long, made from 1-inch square bars, and the floor supports were 7 feet apart. The chains were forged on the spot, and when it was rebuilt in 1909 they had not been painted for 70 years and were in good condition. When the iron was analyzed it was free from slag, which proves that the purer the metal the better it will resist corrosion. The towers supporting the cables were built of masonry up to the under side of the bridge, and the superstructure of the towers was constructed of timber framing, sheathed and shingled on the outside. The towers were 37 feet high above the floor. In 1869 the woodwork was entirely rebuilt. The anchorages were 100 feet back of the towers. Modern traffic was responsible for the passing of this bridge after a century of service. So strongly had it made its impression on the people that the law providing for its rebuilding specified that it should be rebuilt along the same lines as the old bridge.

In 1811, Sir Samuel Brown, of England, first proposed the use of flat bands or links instead of the square and round bars previously used. In 1818, wrought iron bars were introduced. Wire cables were introduced in the early part of the nineteenth century and found special favor in the building of the larger suspension bridges, particularly in France and in America, but eye-bar construction has lasted.



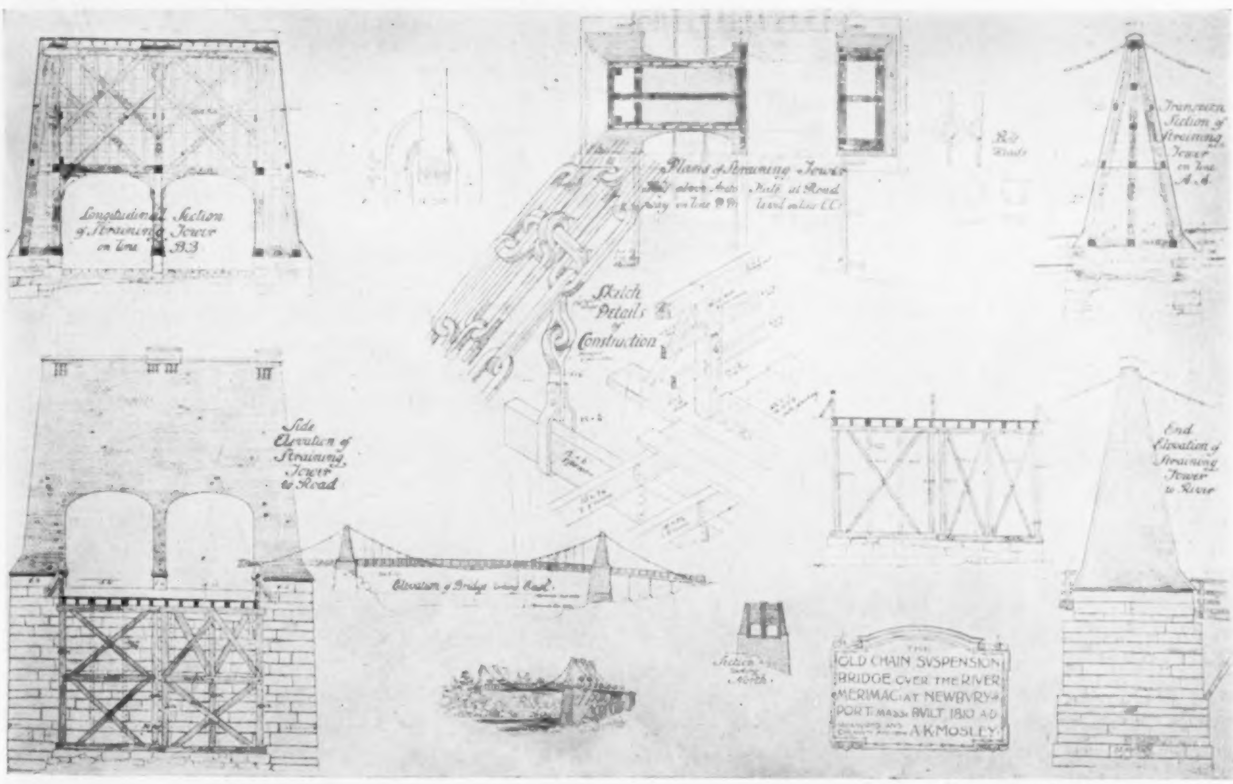
Early Bridge Across Schuylkill, Philadelphia, Built 1809. First Suspension Bridge with More Than one Span



Menai Strait Bridge, Wales, Built 1826; the First Large Suspension Bridge

Suspension bridges usually have either a single span or three spans. The single span has the floor of the central span between the towers supported by the cables, has straight back stays, without suspenders, and the floor of the end spans is supported by steel trusses or columns under the floor. The Williamsburg Bridge is an example of this type. In the three-span suspension bridge the floors of the central and of the end spans are supported by the cables, which makes a much more graceful and symmetrical structure than where the end spans are supported by piers below the floor of the bridge.

The first very large suspension bridge was built in 1826, by Thomas Telford, across the Menai Strait, between the Island of Anglesey and Carnarvonshire, Wales. The central span of this bridge was 580 feet, with side spans of 280 feet, which were supported by four 50-foot stone arches at one end and three similar arches at the other end, making a total length, including the approaches, of 1710 feet. The width of the bridge was 30 feet, having two 12-foot driveways with a 4-foot walk between. The floor was supported by 16 main cables arranged in four sets vertically above one another, one set at each



Courtesy of The American Architect

Details of Chain Suspension Bridge Built in 1810 Near Newburyport, Mass.

Williamsburg Bridge, New York. Central Span Only Supported by Cables

side of each roadway. The masonry towers were 152 feet high and were 29 feet thick at the level of the roadway. Each chain contained five iron bars, 3¼ inches by 1 inch, 10 feet long, united by 8-inch by 16-inch links and 3-inch pins. This bridge was erected over a century ago and is still in use.

Von Mites in 1828 constructed a chain bridge over the Danube Canal, having a span of 334 feet. The cables were flat bars of open hearth steel, and this was the first use of steel for bridge building in any country. In 1860 this bridge was taken down and replaced with a suspension bridge, designed by Schnirch, having a span of 255 feet, and was notable for being the first and only railroad suspension bridge in Europe. In building the early suspension bridges the wires were formed into strands on the ground, and the strands were then raised up to the tops of the towers. M. Vicat, in 1831, first wove the cable in place during the erection of a bridge over the Rhone. At Fribourg, Switzerland, a bridge was erected over the Saone Valley by M. Chaley in 1834. It had a span of 870 feet and a width of 21 feet, consisting of a roadway 15 feet wide and two 3-foot sidewalks. The floor was supported by four iron wire cables, two on each side of the roadway. In 1880 it was reinforced by adding one more cable on each side. This bridge was recently replaced by a massive viaduct, after nearly a century of use.

John A. Roebling greatly improved the design of wire cable suspension bridges. One of his earliest works of this type was the construction, in 1844, of the Pittsburgh Aqueduct across the Allegheny River. This bridge consisted of seven individual spans, each 162 feet in length, and was supported by two 7-inch wire cables. In 1854 Mr. Roebling accomplished the then thought impossible feat of constructing a combination railroad and highway suspension bridge across the Niagara Falls Rapids. This bridge had a span of 821 feet and was the first long suspension bridge to be constructed with stiffening trusses, assuring a rigid floor. Stiffening trusses had been used a few years before on a small suspension bridge over the Kentucky River at Frankfort, Ky., but the span was only of 200 feet. In 1867 a bridge was built across the Niagara River a short distance below the falls, by Samuel Keefer of Ottawa. It had a span of 1260 feet, and the clear width of the roadway was only 10 feet, which did not permit carriages to pass, and in 1888 it was widened to 17 feet. The cables were of iron wire, which was imported from England, and were supported on wooden towers.

For years John A. Roebling had been studying the possibilities of spanning the East River with a bridge. His production of drawn steel wire made the erection of the Brooklyn Bridge a possibility. All previous suspension bridges' cables were fabricated from wire drawn from charcoal iron, the Brooklyn Bridge being the first in which steel wire was used. The protection of the wire in the cables had been oil, grease or paint. In the Brooklyn Bridge galvanized wire was used, thus introducing zinc for the first time as a protective coating for bridge wire. The Brooklyn Bridge was completed under the direction of Col. Washington Roebling in 1883, and at the time was one of the wonders of the world, far outranking in size any similar structure. Its simplicity, ruggedness and beauty of line have made it a bridge that it is difficult to surpass. The central span is 1595 feet, 6 inches long, with end spans of 930 feet. The total length, including the approaches, is 5989 feet. The width of the bridge is 86 feet and has accommodations for two elevated railroad tracks, two trolley tracks on the 17-foot roadways, and a raised center walk, 15 feet wide. The

Aërial View of Delaware River Bridge, Completed 1928

bridge is supported by four cables, each 15¾ inches in diameter, which are carried on stone towers 278 feet above water. The clearance is 135 feet, as required by the War Department.

The longest suspension span now existing is that of the Camden-Philadelphia Bridge over the Delaware River, completed in 1928. This bridge has a central span of 1750 feet and end spans of 716 feet, 8 inches. The total length, including the approaches, is 8240 feet. The width of the bridge is 128 feet, 6 inches, and it has a 57-foot roadway for six lanes of traffic, four tracks for rapid transit, and two elevated footwalks each 10 feet wide. The bridge is supported by two wire cables each 30 inches in diameter, which are carried on steel towers 380 feet above the water. The clearance under the bridge is 135 feet. This bridge was designed and constructed under the direction of Ralph Modjeski, chief engineer, and Paul Cret, architect.

During the last 25 years no new types of suspension bridges have been introduced, but considerable advance has been made in design. The quality of material has been improved, and its strength has been greatly increased. The testing laboratories which now exist have given engineers more complete knowledge of the materials with which they are working The perfection of the pneumatic caisson has made it possible to build foundations for structures in locations that were considered impossible.

The Port of New York Authority is now building a suspension bridge to cross the Hudson River from Fort Washington Park at 178th Street, New York, to Fort Lee, N. J. This bridge has a span of 3500 feet, which is twice the length of span of the longest existing suspension bridge. The bridge is being designed and constructed under the direction of O. H. Ammann, Chief Engineer of Bridges of the Port of New York Authority, and Cass Gilbert, architect. Some laymen have questioned the feasibility of constructing such a long bridge. Mr. Ammann, in his first progress report on the Hudson River Bridge, says that "engineers familiar with the design and construction of large bridges have pointed out from time to time that the feasibility of building a bridge of as long a span as 3500 feet and more is esentially a question of economy, and that the span length and size of bridge have nothing whatsoever to do with its safety, either during erection or after completion. The feasible limit of span is reached when the amount of metal required to carry a given load becomes excessive in cost, and not because the safety is impaired. The physical limit of span is reached when no amount of metal can safely carry more than its own weight. The latter limit can be mathematically determined for the safe strength of any given material, and has been calculated by various authorities at 10,000 feet and more."

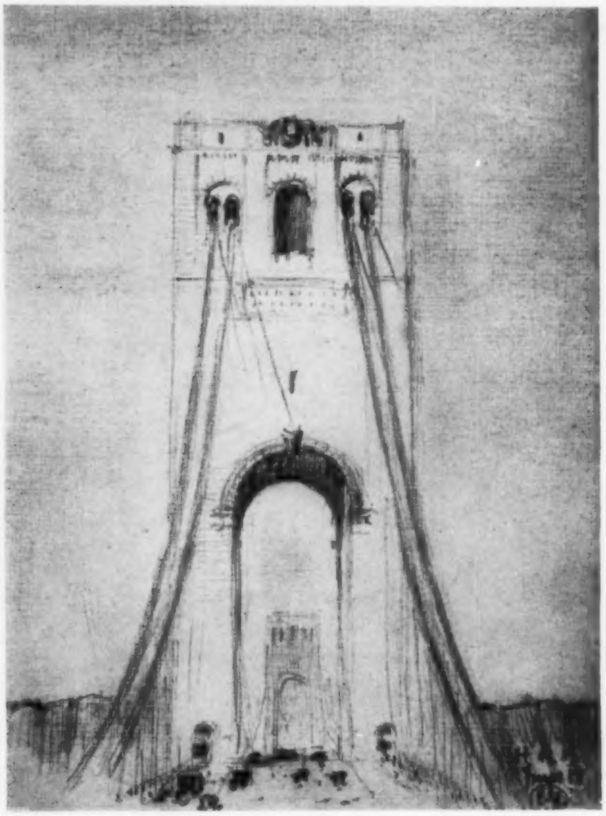
The location of the Hudson River Bridge is well suited to a suspension bridge on account of the high land on both sides of the river at this point, which makes it possible to construct a bridge with comparatively short approaches. The side spans of this bridge are 650 feet long, and the total length including the approaches is 7800 feet.

The width of the bridge floor is 118 feet, and there will be a central roadway 40 feet wide for four lanes of traffic, two side roadways each 24 feet wide accommodating two lanes of traffic, two footwalks each 11 feet, 6 inches wide, and a lower level for either four or six lanes of rapid transit as conditions require. The bridge floor will be supported by four wire cables, each 36 inches in diameter,

GENERAL VIEW OF HUDSON RIVER BRIDGE

VIEW OF HUDSON RIVER BRIDGE SHOWING NEW YORK ANCHORAGE AND APPROACH
CASS GILBERT, ARCHITECT
O. H. AMMANN, CHIEF ENGINEER OF BRIDGES, PORT OF NEW YORK AUTHORITY, ENGINEER

Preliminary Perspective of New York Approach, Hudson River Bridge

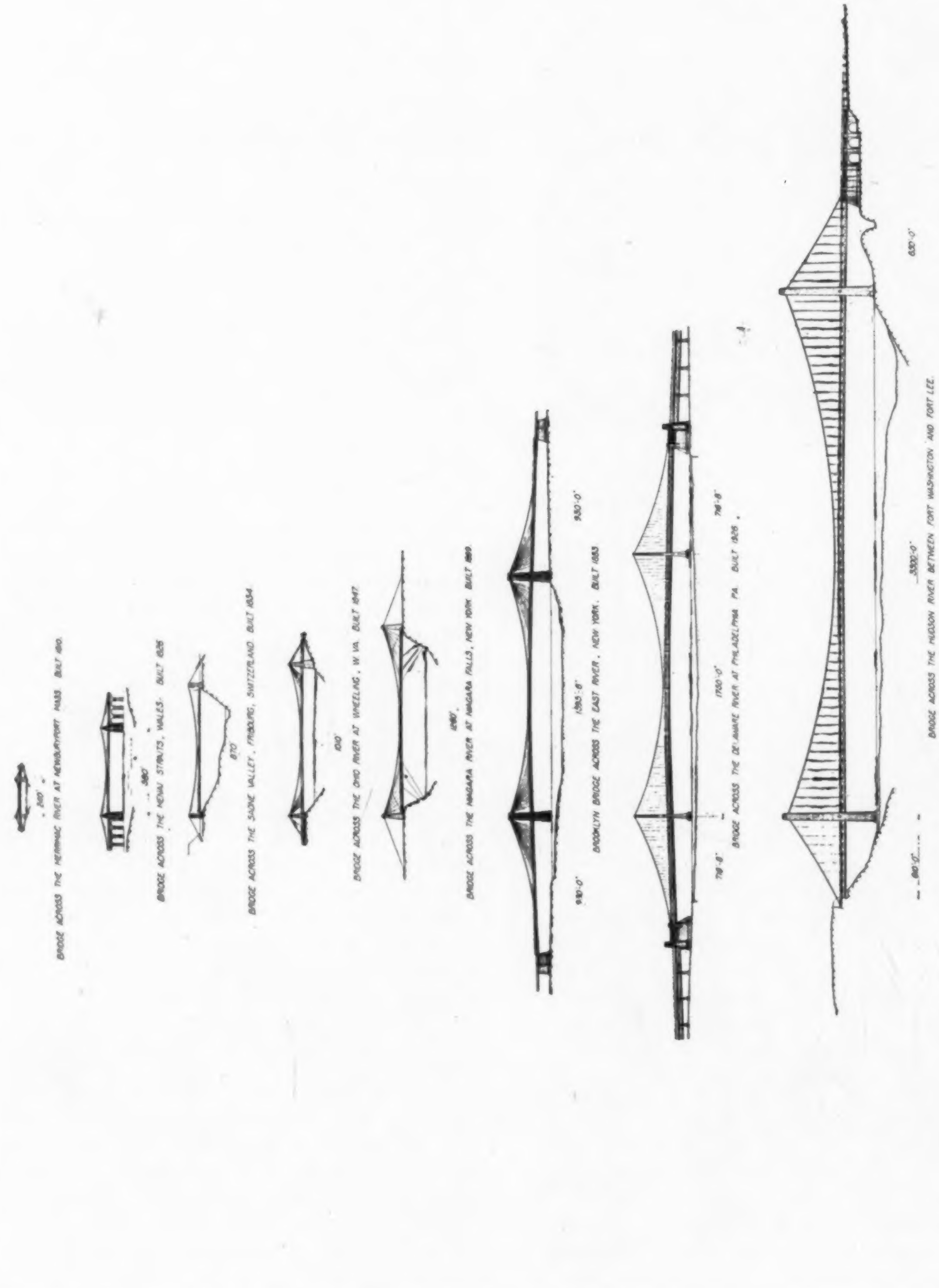


Preliminary Study of Tower Design. Original Sketch by Cass Gilbert, Architect

Each cable will be composed of 26,474 wires or a total of 105,896 wires. The cables will be supported on steel and masonry towers, 210 feet by 65 feet at the base, and 635 feet above the water. Comparing the towers with the Washington Monument, which is 55 feet square at the base and 550 feet high, some idea may be gained of the stupendous size of this structure. The roadway of the bridge is 253 feet above the water at the center of the bridge, and it passes through the towers beneath a great arch 95 feet wide and about 230 feet high. The clearance under the bridge is 213 feet at the center of the bridge, and 195 feet at the towers. The New York anchorage is an almost solid mass of concrete and masonry, 290 feet by 200 feet at the base and 130 feet high, in Fort Washington Park. The New Jersey anchorage consists of steel beams and eye-bars which are buried 240 feet in the solid rock of the Palisades.

The New York approach connects with Broadway, and it crosses Riverside Drive on a series of massive masonry arches about 75 feet high, while at the new Jersey approach the roadway strikes the face at the Palisades about 50 feet below the top of the cliff. From this point it rises at a 4 per cent grade to the plaza at Lemoine Avenue. New highways that are being constructed will care for the tremendous amount of traffic that will be carried over this bridge. Realizing the monumental size and conspicuous location of this bridge, the Port of New York Authority is paying special attention to the architectural treatment of the entire structure and approaches so that it will be handed down to posterity as one of the great monuments of the world.

The effect that a bridge has upon the community was thus admirably expressed by "C.D." in "The Brochure series:" "Of all architectural sins, the building of an ugly bridge is perhaps the most egregious. Structures of other sorts may be overshadowed by charitable neighbors or shrouded with trees and vines; but a bridge, whether part of a river landscape in the country, or a thoroughfare and landmark in the city, always ends the vista and fills the eye. On the other hand, a beautiful city bridge, stately and monumental, often affords, with the sweep of its arches, the only graceful structure among the surrounding marts; while in the country it may complete and humanize, with the touch of man's hand, a natural scene, and thus become an architectural achievement that is a joy more likely to 'endure forever' than most objects to which the trite phrase has been applied; for thoroughfares of travel when once established are inflexibly conservative."



Courtesy, Port of New York Authority

GROWTH OF LENGTH OF SPANS OF SUSPENSION BRIDGES SINCE 1800

STRUCTURAL FEATURES OF SOME MODERN AMERICAN CHURCHES

BY

EMIL PRAEGER, ENGINEER

Of the Office of Mayers, Murray & Phillip, Architects

EUROPE has always possessed a lure for students and lovers of architecture, and especially of church architecture, but the time is not far off, if it is not now here, when Europeans will profit by studying the church architecture of America. Although the ritual of the church service has changed less with time than have many other customs, the method of church building seems to be keeping pace with other changes in methods of doing things which have been taking place in recent times.

The reasons for this condition are not difficult to determine. In the construction of the mediæval churches, many years and often centuries were spent in finally completing a building. Even in small towns and rural places, the building of a place of worship often represented the chief lifetime labors of a group of workmen, and under these conditions it is not surprising that the workers took an extreme interest in the task, in many instances approaching the attitude of an artist towards his masterpiece. As evidence of this one need only realize that the exquisite carvings of wood roof trusses, pews, chancel and other furniture seen in the old rural churches are the result of the painstaking labors of village or town carpenters and craftsmen.

How different are conditions in this country today, with respect to both rural and urban churches! The village carpenter or mason would find it difficult to supply gasolene for his automobile if he had to depend chiefly on the building of the community church for his life income, and parishioners are too up-to-date to sanction obsolete procedure. It does not follow that there are no examples of well designed small churches in this country; on the contrary, there are some excellent examples, but they are exceptions. In these, moreover, aside from the time element, there have been no great changes in methods of design or construction from those followed by the older church builders. In the larger churches, it is now neither practical nor necessary to build piecemeal, and the method of building is bound to have an effect upon the finished structure. In the cases of the old cathedrals, highly trained engineers were not available to the architects, but internal and external forces and stresses in structural members were understood and considered, although not always adequately. Failures were not unknown, and much knowledge of building methods was gained through this not altogether satisfactory method of "learning." The paths of forces and stresses in a Gothic structure are not as easily defined as is the case in a framed building, and therefore, contrary to a somewhat general opinion, the solutions of their problems are necessarily usually more complicated than is the case with steel framed buildings, the post-lintel-and-truss type.

During the past few years there have been some very excellent churches constructed in this country, and there are now four or five being erected in New York, the construction of which is of interest to the architect as well as to the crowds that watch the steam shovel or steel derrick. These churches may be divided into three constructional classes; namely: (a) Masonry Framed, (b) Reinforced Concrete Framed, and (c) Steel Framed.

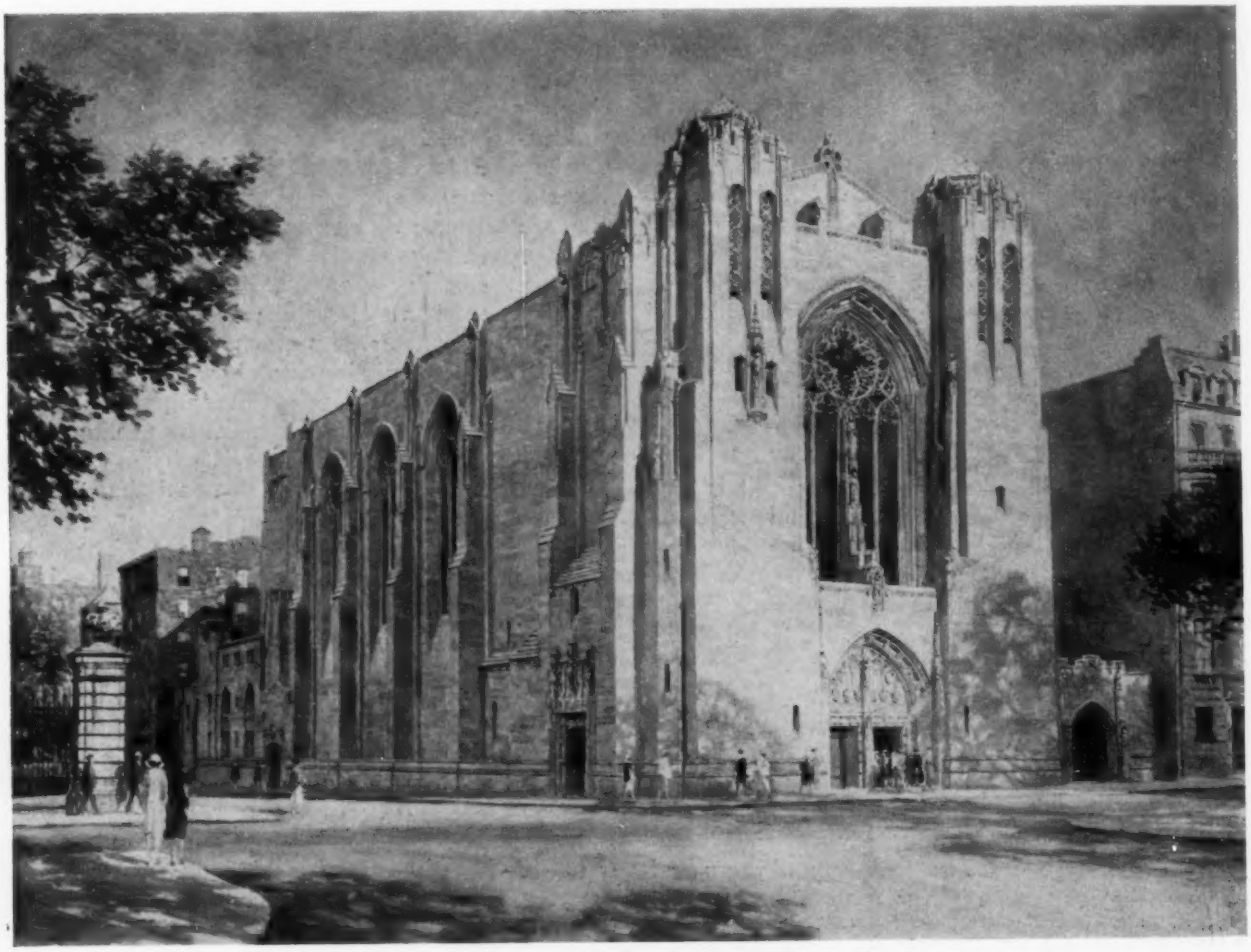
The first class represents the traditional method and needs little introduction. Walls, piers and buttresses are constructed of brick or stone masonry, and the roofs are supported by trusses. In some cases there is a ceiling over the nave constructed of stone, tile, or plaster, in which case simple wood or steel roof trusses are used. Where there is no ceiling, the trusses are generally of wood, of the hammer beam type, which exert a thrust on the buttresses in the same manner as do arch ceiling ribs. The Cathedral of St. John the Divine, Cram & Ferguson, architects, now under construction on Morningside Heights, is an excellent example of this class of construction. As an example of the second class, there is the new edifice for the Church of the Heavenly Rest and the Chapel of the Beloved Disciple, now being built on upper Fifth Avenue, of which Mayers, Murray & Phillip are the architects. Of the third class, the "Riverside Church," on Riverside Drive, and the Temple Emanu-El on Fifth Avenue, are examples. The architects for the former are Henry C. Pelton and Allen & Collens, associated, and for the latter Robert D. Kohn, Charles Butler, and Clarence S. Stein, associated; Mayers, Murray & Phillip, consultants. An account of the construction of the latter building was ably presented in the July issue of THE ARCHITECTURAL FORUM.

In the case of the Cathedral, the foundations are of concrete, and the nave floor is of tile vaulting. The exterior walls are of granite, and the smaller interior piers are solid granite, while the larger piers have granite cores faced with limestone. The ceiling, a series of structural tile vaults with the first course of an acoustical composition, is supported by limestone ribs. Steel roof trusses and steel purlins support the concrete roof slabs to which is secured the lead-coated copper roofing. While the building is extremely modern in regard to equipment and appointment, the type of construction follows that employed in the older European churches in which masonry buttresses resist the thrust of either the hammer beam trusses or arch ribs. There are, of course, details developed for this building which are not common,—as, for example, the method which will probably be used for supporting the central tower by intersecting stone arch ribs,—but the main

Interior, Church of the Heavenly Rest

difference between the methods of building this and the older structures lies in the time consumed in building and the tools and apparatus employed. Modern tools have made it possible to use stones much larger than could formerly be handled easily, with the result that solid piers of great dimensions are now possible.

In the smaller piers of the Cathedral of St. John the Divine, the blocks are 5 feet in diameter and weigh approximately 4 tons each, while in the larger piers, stones weighing as much as 8 tons each were used for the cores, and these were bonded with the limestone facing. In the European churches a usual method of constructing piers was to build a face stone shell and to fill this shell with rubble masonry. Failures due to this type of construction have been only too numerous, and the recent experience at St. Paul's Cathedral in London should be a warning against use of this method. The steel scaffolding of the nave of St. John's, of an original and unusual design, was developed to meet existing conditions. As the structural tile floor of the nave, which was constructed some years previously, could not have safely supported the heavy constructional loads, it was found necessary to concentrate these loads upon the foundations of the nave piers, and therefore the ordinary timber scaffolding could not be used. The

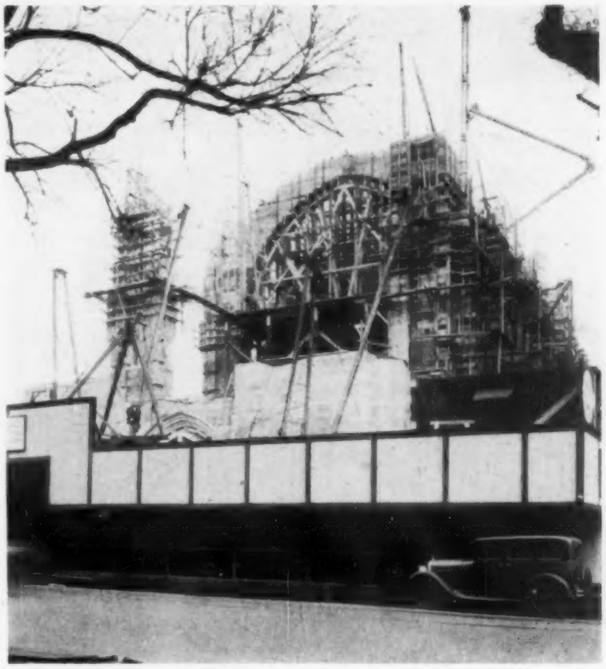


Church of the Heavenly Rest and Chapel of the Beloved Disciple, New York

Mayers, Murray & Phillip, Architects

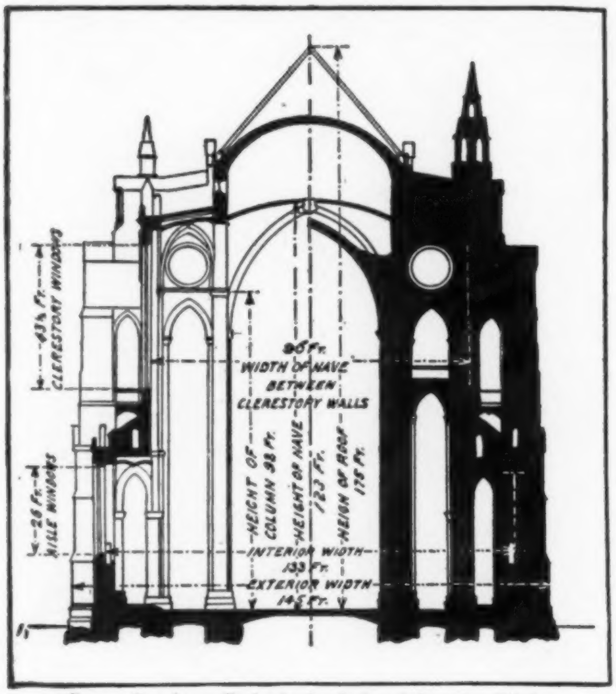
equipment of the stone plants of the Cathedral is modern in every detail, much of the apparatus having been developed to meet the requirements of this particular building. The interest shown by the workmen is unusual for present-day construction work. This care and interest are bearing fruit, and there has been much favorable comment regarding the resulting stonework.

Most large churches in this country have been constructed following the same general principles as St. John's,—for example, St. Patrick's Cathedral and St. Thomas' Church in New York, to name only two. Where special or unusual conditions do not dictate otherwise, there is no objection to continuing the use of older methods of construction, especially for churches of Gothic design. In the construction of the church of today, local conditions may be such as to require a modification of the mediæval methods of construction. In the case of the Church of the Heavenly Rest and the Chapel of the Beloved Disciple, for instance, the imposed conditions were numerous and not easily met. A site had been purchased on the southeast corner of Fifth Avenue and Ninetieth Street, facing Central Park. The building committee was composed of men who, in addition to having an intimate knowledge of church design, had an ambition to build a church which, while

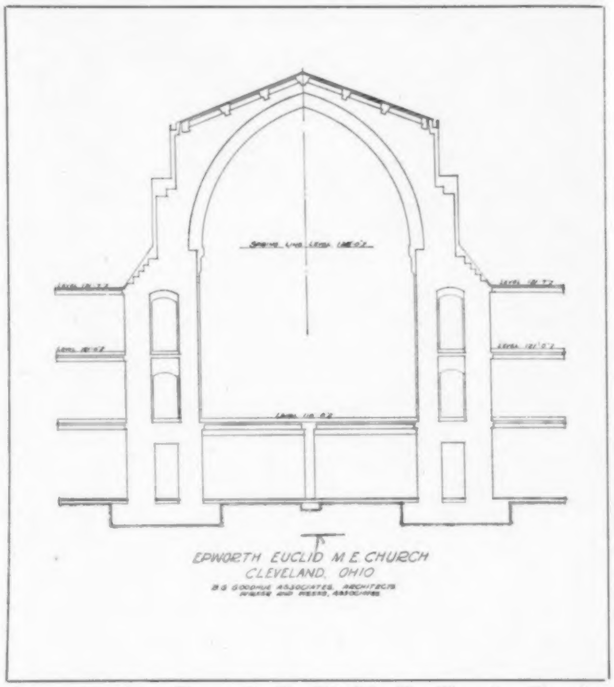


Construction, Showing Formwork for Piers and Arches. Stonework of Front Under Way. Church of the Heavenly Rest, New York

Church of the Heavenly Rest Nearing Completion
Mayers, Murray & Phillip, Architects



Cross Section, Cathedral of St. John the Divine
Cram & Ferguson, Architects



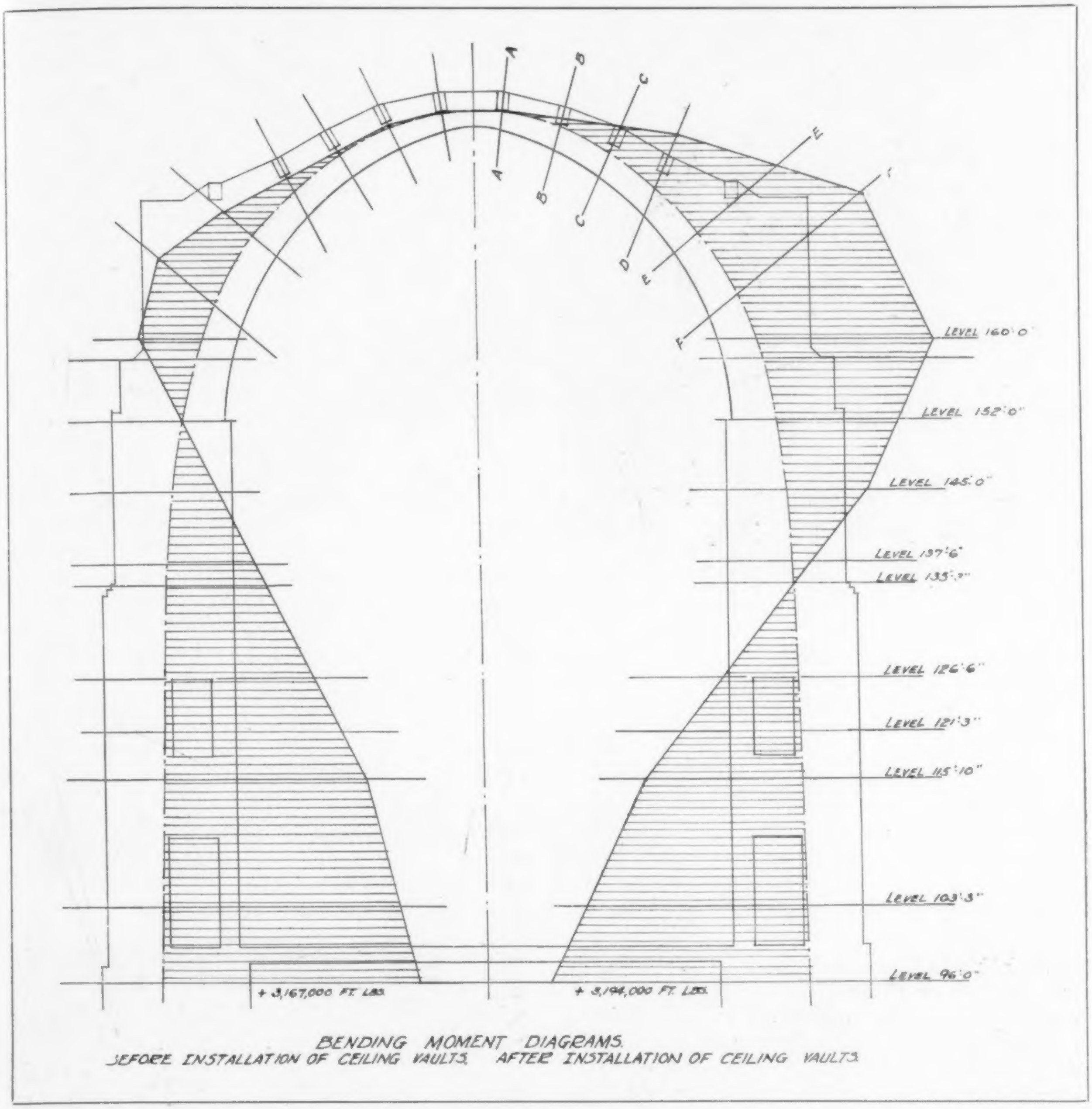
Cross Section, Epworth Euclid M. E. Church, Showing Adjacent Sunday School Floors

Gothic in character, should be American in style and would typify the spirit and trend of the present. If at this time I pay tribute to the late Bertram Grosvenor Goodhue, whose ambition it was to create an architecture of the present rather than a copy of the past, I trust that I shall be pardoned. It was always gratifying to Mr. Goodhue to have his designs referred to as "American" in style,—a term that was coming into almost general use in connecnection with Mr. Goodhue's buildings at the time of the death of this eminent architect. He has sown the seed of his genius, and those who follow are bound to profit by his influence.

Considerable time was spent on preliminary studies for this church, and many different schemes were tried before working drawings were started. In addition to pencil sketches, perspectives rendered in wash, water color and oil were made. Numerous models were made both with plasteline and cardboard until finally a scheme which met all requirements was evolved. In studying this problem the use of models proved extremely helpful. At first it


Cathedral of St. John the Divine Under Construction


Interior of Epworth Euclid M. E. Church, Cleveland



Section and Bending Moment Diagrams of Nave Ribs, Church of the Heavenly Rest, New York
Mayers, Murray & Phillip, Architects

was proposed to build a tower at the front elevation, but by the study of models it was found that if apartment buildings of the usual height were later constructed adjacent to the site, the church tower would be dwarfed in comparison.

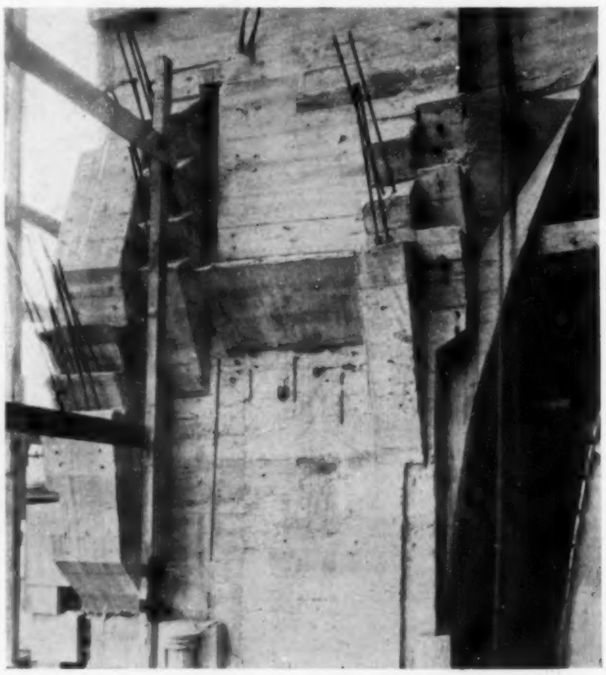
The site selected has a frontage of 100 feet on Fifth Avenue and 255 feet on Ninetieth Street. The church proper will have a seating capacity of 1,000, and the chapel will seat approximately 200. Under the nave there are crypts and a mortuary chapel. At the east of the church is a parish house, which contains the heating and other mechanical equipment in the sub-basement, a gymnasium in the basement, an auditorium on the main floor, while the five additional floors are divided into various guild rooms and offices for the working departments of the church. The parish house is similar in structural requirements to a modern club or office building and was constructed of steel frame with concrete floor arches and with limestone curtain walls; this section presented no unusual problems. The structural problems of the church proper, however, were more difficult of solution. The first condition imposed was that every pew have an unobstructed view of the altar. To accomplish this, all pews had to be placed between the main piers, and this required a clear space between faces of opposite piers of 46 feet. Although there are some few Gothic structures of greater span than this, they are extremely rare. In addition to this requirement, there

Construction, Church of the Heavenly Rest

was a restriction as to the height of the roof line above the curb level. For the central span, as here required and for other architectural reasons, it was necessary that the clear height of the nave ceiling be not less than 80 feet, so that, after allowing for the thickness of the ceiling construction, only 3 feet, 2 inches was available for roof construction at the crown. The usual type of roof construction for Gothic churches consists of wood purlins and wood trusses which form a comparatively light structure. With this type of construction, the vertical reactions of the trusses assist the buttresses in resisting the thrust of the ceiling ribs. This is not the case with the church now under construction, as wood construction is not permitted by the New York Building Department, and poured concrete was used for the roof slabs and beams. The slabs are of special composition with nail-retaining qualities, which material is also here desirable because of its light weight, being only little more than half that of stone concrete. Copper, coated with lead, was used for the roofing, making a light-weight, permanent, and beautiful finished roof. The roof slabs are supported by gravel concrete beams spanning between the main nave ribs. The latter ribs occur at each of the nave piers, and are 28 feet, 4 inches on centers. It was the construction of the ribs and piers which offered the gravest structural problem. In most Gothic churches, the arch ribs support only the ceiling, and the structural roof, as noted previously, is supported independently. Even under these loading conditions, great buttresses are found to be necessary. In the case of St. John's, the clear span between the nave piers is approximately 45 feet, while the distance from the interior faces of these piers to the exterior faces of the buttress is approximately 50 feet. The Liverpool Cathedral, another great modern structure, has a nave width of 40 feet between piers, and a buttress depth of approximately 50 feet. In both instances it is seen that the effective depth of each buttress is greater than the clear span of the supported arch rib.

At Heavenly Rest the entire depth available for each buttress at the base, instead of being greater than the clear span between piers, is less than one-third of this dimension. Considering the fact that the value of desirable city property is constantly increasing, it is probable that few city churches will be constructed in the future with buttresses utilizing a space more than twice the width allotted to pews.

The limitation of height of roof line and the desired height of ceiling made it necessary to devise a scheme whereby the cross ribs would carry the roof load in addition to the ceiling load. The limited depth available for the buttresses, however, made this scheme, if designed according to the usual theories of masonry arch and buttress construction, out of the question. The depth of buttress depends on several factors,—namely, the span and curvature of the arches, the amount of load carried by the arches, the distance from the base to the intersection of arch and buttress axes, and several other factors. Because of the long clear span and the extremely unusual loading conditions just noted, the thrust upon the piers would be much greater than is generally the case, and an enormous depth of buttress would be necessary to resist the thrust of a voussoir or plain concrete arch rib designed for these conditions. At Heavenly Rest, with a greater clear span and greater loading conditions than at either St. John's or Liverpool Cathedral, the total depth of buttress from point of moulding to finish exterior surface

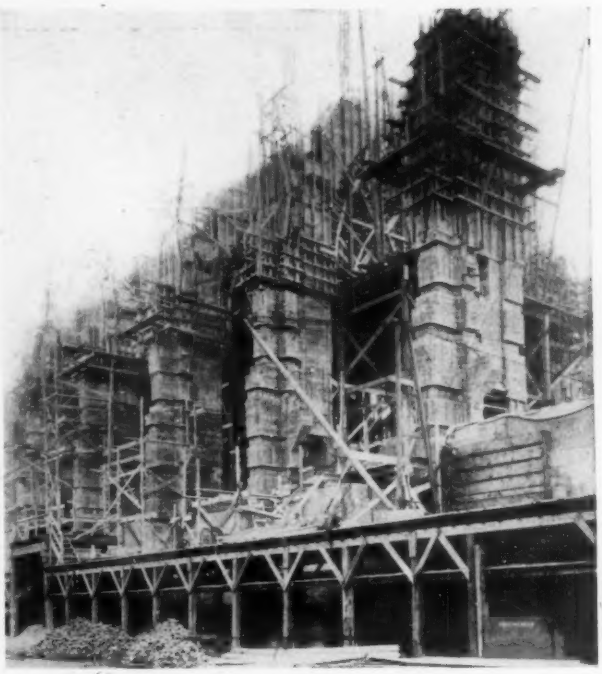


Corbels to Receive Spandrel Wall Arches and Ceiling Vaults

is only 15 feet, 2 inches, as compared with 50 feet for the latter structures. In order to meet these conditions satisfactorily, it was necessary to study the structural problem from a different angle, and numerous schemes and extensive calculations were made. The scheme finally adopted, however, entirely satisfies all loading conditions without in any way encroaching upon the original allotted dimensions. It was found necessary to use reinforced concrete and to consider each main pier and arch rib as a continuous bent reinforced concrete beam. In other words, one pier and half the rib between opposite piers are considered as a bent cantilever beam supported at the base, with the free end at the crown. There were other possible methods of solution, but this method proved most desirable.

The piers and ribs have varying amounts of continuous reinforcing, as required by calculations, and opposite piers are tied together with a wide tie at the nave floor, forming a continuous frame. These ties incidentally also act as floor girders. It was necessary to investigate the ribs under two different conditions of loading: first during the erection of the building after the roof was constructed but before the vaulted ceiling was in place; and second, after the structural tile ceiling and its stone ribs took bearing against the piers. The piers and ribs were completed in six or seven pourings, with construction joints designed in accordance with the nature of the stress at the particular section. There is a construction joint about 14 feet on either side of the crown, another near the spring, and others at convenient locations on the piers. Considered as a column, the ribs are subject to direct stress of compression due to dead weight and roof loading. Considered as a beam, the bending moments produce tension on

Tops of Ribs, Roof Slabs and Beams, Church of the Heavenly Rest



Piers Nearly Completed, Showing Recesses for Stone Facing

one side and compression on the other side of the neutral axis. At the crown the only bending moment is that caused by temperature changes and secondary stresses caused by possible deflection. From the crown to the buttresses the bending moment is negative (that is, tension is at the top of the section) and increases in intensity gradually to a maximum at approximately Elev. 162, where it begins to diminish until it changes sign at Elev. 152, before the vaulted ceiling is in place, and at Elev. 134 after the vaulted ceiling is installed. Below this level the sign is positive, or in other words, the bending moment produces tension on the interior and compression on the exterior sides of the piers. It was decided to start the reinforcing 4 feet under the nave floor, so that at this location there can be no tension, and therefore the compressive stress due to vertical loading must at least counterbalance the tension due to bending. Knowing this, the bending moment at the base was determined, and then the crown thrust or tension could be computed. With this known factor the bending moments and shears at any other section could be determined and the stresses in the concrete and reinforcing computed. A rich mix of concrete was used, and very rigid supervision and careful control of material were maintained, especially during the pouring of these principal members. The cement water ratio and other modern methods were followed throughout the work, and laboratory tests showed an unusually uniform resultant concrete.

The interior of the church has a buff sandstone finish, while the exterior stonework is of limestone. Every fifth stone is a bond stone 8 inches thick, and the others are generally 4 inches thick. It was necessary to provide recesses in the concrete piers to receive the bond stones, and these recesses had to be

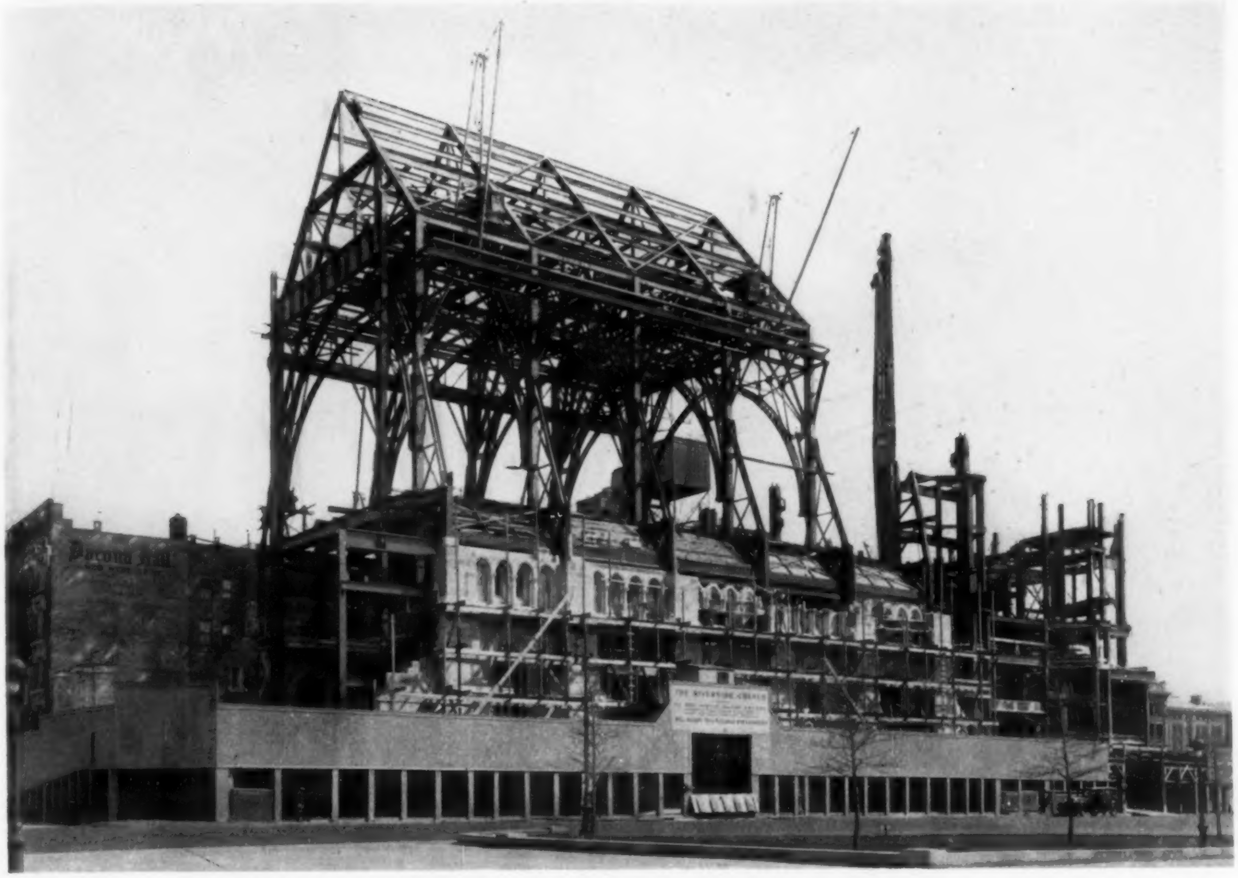
Perspective, "Riverside Church," New York
Allen & Collens, Architects

accurately located before pouring the piers. This required detail drawings showing the exact locations and depths of all stones and the desired provision for bonding them. Dovetail anchor slots and galvanized anchors were also used to insure as nearly a perfect connection of stone and concrete as possible. One inch was allowed for grout between the back of the stone and the face of the concrete. At junctions of concrete piers and brick or stone walls, the concrete was toothed so that the masonry courses bonded exactly with the concrete. Skewbacks were provided on the concrete piers at the springs of all arches, ribs, vaults, etc., and in addition, corbels were provided at different levels projecting into the spandrel walls in such a manner that the weight of these walls was transferred to the concrete piers, thus tying the entire structure together.

Although the stone was not a factor in the structural design, tied and bonded to the concrete piers as it is, it unquestionably adds considerable strength to these members, and can be considered as an additional safety factor. The stonework was not started until after the concrete had been poured for several weeks, during which time the concrete was kept moist (especially in warm weather) by allowing water to trickle over the top of the section last poured.

In view of the fact that there have been a number of buildings constructed in recent years in which the stone facing has cracked quite badly, this subject was given careful consideration. The causes of such cracks may be traced to unequal settlement of the stone due to unequal shrinkage of the mortar joints of the stone and brickwork, differences in the rates of expansion and contraction between facing and backing with the temperature changes, or to other similar causes. Such a movement might load some stones beyond their capacity and therefore cause unsightly cracks. To overcome this condition, a continuous lead shield in which a corrugated lead sheet is inserted was placed in alternate bond courses on top of the bond stones. The thickness of this pressure-relieving pad is ¼ inch, and as the stone joints are ⅜ inch, it was possible to install a leveling bed of mortar either on top of or under the pad, or in both places if found necessary. If there is any unequal movement of stone, this movement will not act over a height greater than the distance between the pressure-relieving pads, and there is more than enough elasticity in this material for it to act as a spring and prevent excessive load coming on any one stone or portion of a stone. The pads are kept back from the face of the stone about ⅛ inch, and this space is filled with a skim coat of pointing mortar. No difficulty was experienced by the stone masons in fitting the various stones into the grooves which had been provided in the concrete piers. As to economy, I am sure that the cost as now built would compare favorably with that of any other method of construction for a church of this size and character. The time required to build this type of frame should, under ordinary conditions, be less than that required for the usual type of masonry construction.

The architectural features have not been touched upon, and these should furnish the basis of some interesting studies in the future. The mechanical details are also in keeping with the best modern practice, and there are many features entirely original with this building. A careful study was made of the lighting requirements, with the result that use of the usual ornamental nave lighting fixtures has given way to use of a system of concealed lighting. In the design and construction of Heavenly Rest, the fact that the architects were endeavoring to build a monument to last for centuries was never lost sight of. Due to New York's climatic conditions, this is a greater problem than the builders of the mediæval European cathedrals faced. The architects feel reasonably sure, however, that this edifice will be structurally sound for ages, and perhaps some day will be pointed out as an example of the church architecture of the early twentieth century. There remain, nevertheless, further opportunities for development. The tile ceiling, while excellent from an acoustical standpoint, adds considerable expense and might be dispensed with under certain conditions. In this case, the structural concrete roof could be designed to form also the finish ceiling with decoration applied directly to the concrete or to an acoustical application, if such material is found necessary. This method of construction was followed in the frame of the Epworth Euclid M. E. Church, recently completed in Cleveland. Here the problem of resisting the arch thrust was not so complicated because the roofs and floors of the Sunday School building adequately take care of these reactions. The arch rib and supporting piers were faced with cast stone resembling limestone.

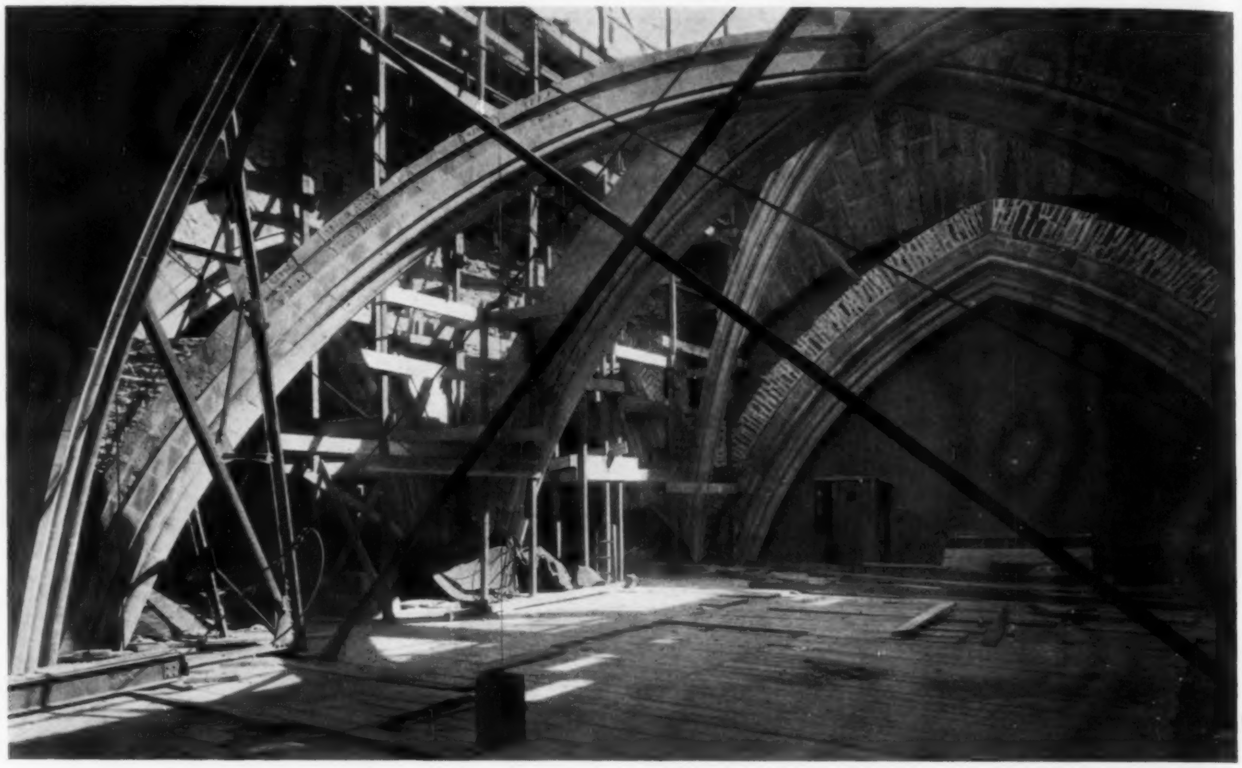


Construction Showing Steel for Roof and Ceiling. "Riverside Church," New York
Allen & Collens, Architects

Mention has been made of two structures in which reinforced concrete, in the form of arches or arch ribs, has played an important structural role. There have been many other buildings designed by the firm with which I am connected, where conditions have been such as to make the use of this type of construction advisable,—for instance, the crossing arches and piers of St. Bartholomew's Church, New York; the Trinity Lutheran Church at Fort Wayne; the chapel for the University of Chicago; and others,—so that it is not an experimental method. Reinforced concrete was used in each case only because it best fitted solving the problem at hand.

As the next step in the development of modern church construction, the possibility of entirely omitting the facing material from the structural piers presents itself. With the advance in our knowledge of reinforced concrete and with improvements in the finished product, as to both color and texture, this step will follow, and indeed it has already been attempted in several churches in California, as well as in Europe. As a still further development, the creation of an entirely new style of architecture might follow, a style developed to fit our special needs and conditions. Reinforced concrete will unquestionably play an important part in this development, as it offers unlimited opportunities to the designer's imagination. At the same time, it is not necessary to throw tradition to the winds, to forget everything that has been accomplished in the past and try to create a new architecture overnight to fit use of this modern material. We should not become slaves to a material but rather develop new forms slowly and as the requirements at hand seem to demand. The recent examples of modernistic French churches built of reinforced concrete are interesting and ingenious, but they are hardly appropriate for present American conditions.

In regard to the third type of church construction,—namely, the steel frame,—I cannot quote from personal experiences, as the office with which I am connected has not used this type of construction to any great extent. However, if steel, stone, brick, wood, or concrete or any other material is best suited to the particular conditions at hand, there is no reason why any or all of these materials should not be used. Steel has proved, beyond dispute, to be one of the strongest and most dependable building materials known. Its strength per square inch, both in tension and compression, is greater than that of any other practical building material. If, by its use, structural problems can be solved which would otherwise prove insolvable, it would be unwise not to use steel for a church, as well as for an office building, even though this material was not used in the construction of mediæval churches and cathe-



Limestone Ceiling Ribs, Weighted with Concrete or Rubble Masonry, Cathedral of St. John the Divine
Cram & Ferguson, Architects

drals. Such use of steel is now being made in the construction of the Riverside Church and in building the Temple Emanu-El. In both instances, maximum capacity was required of the areas available, again rendering use of the traditional methods of construction impossible. In the Riverside Church a total seating capacity of approximately 2,500 was required, and practically all seats had to have an unobstructed view of the pulpit. The total width of the property is only 100 feet, and a clear width of 60 feet between buttresses was found necessary. From the inner face of the buttress on the west to the property line is 22 feet, while the similar dimension on the east is only 18 feet. The height of ceiling above the nave floor is 102 feet. To satisfy these conditions, impossible with stone masonry, the use of structural steel was decided upon. Steel columns extend through the nave piers and support steel ceiling ribs and steel roof trusses. The ceiling is tile of the color and texture of limestone and having excellent acoustical properties. A huge tower is to be supported by heavy steel members, and by thus resorting to use of modern methods and materials, maximum strength is gained with a minimum sacrifice of space. The time required for such building is less than would be needed for solid masonry construction.

The Temple Emanu-El is not a Gothic type of structure, but here again the condition was imposed that all pews have an unobstructed view of the pulpit, and in order to accomplish this for a seating capacity of 2,500, a clear span between nave piers of 77 feet was required, leaving only some 13 feet for the total width of each pier. Steel roof trusses were used to span the nave, and the trusses are supported by steel bents designed to withstand safely the horizontal component of the wind load, as well as the vertical reactions of the trusses. The steel bents are encased in concrete, and the stone facing is then anchored to this frame by means of anchors and anchor slots cast in the concrete.

While commercial buildings have become highly specialized and modernized, church design is also undergoing changes, and how near we are now to the best solution, time alone will tell. The structural features of only a few important churches have been described here, and while these matters are extremely important and at times offer problems difficult of solution, they should not influence or restrict the architect to too great an extent. With advance in our knowledge of structures and structural materials, the architect will be obliged to modify his ambitions less often, and the more capable we become as engineers, the fewer will be the restrictions placed upon the architect. We are now living in an age of specialization, but to obtain the full benefits of specialization, we must also have close coöperation between the various specialists. Without the creative skill of the architect, the engineer would have fewer opportunities to exercise his ingenuity and technical skill. Coöperation between architect and engineer should exist from the inception of the design, as it may be difficult or impossible to compromise after a scheme has been adopted. When such exists, the best results will be obtained.

THE PARABOLIC ARCH AND VAULT

BY

FRANCIS S. ONDERDONK

THE parabolic arch is both logical and beautiful Hundreds of concrete bridges show its dynamic grace. If spanning a void is the main problem of architecture, bridges may be considered as showing us an ideal solution, for where could a form undergo a more severe test as regards its æsthetic value than when placed to serve a utilitarian purpose in a natural setting of rhythm and serene beauty? The parabolic bridge has become a standard type, not only because it is the most economical type, but also because the beholder senses its beauty. If it be acknowledged that sincerity is an essential element of the beautiful, it is significant that bridge builders prefer the parabola. Brick and stone construction would be too cumbersome, steel too skeleton-like to produce such elegant, thrilling arches as those shown in Fig. 8. Only ferro-concrete, with the advantages of steel and stone, can be used in quite this way.

In reinforced concrete, columns and beam, walls and vault become one. For this reason the rigid frame, which in Europe is used so frequently for large halls, is typical of ferro-concrete. This bent has structural advantages due to the continuity of bending. Some designers place such a frame on hinges, while others connect it rigidly with the foundation. The hinged type has columns tapering downward, i.e., growing narrower toward the floor, because stiffness must be increased at the top, and there the column is widest (Figs. 1, 5).

As in former transition periods, the old forms are resurrected in the new material. The now dominating type of frame, two posts connected by a beam, is reminiscent of use of the old materials, just as the V-frame (Fig. 3) is due to the traditional type of roof. Gravity demanded vertical piles of stones or bricks to avoid centering; wood and steel encouraged angular outlines, but "liquid stone" requires no straight lines. Its form can express the structural facts: sides and top, walls and roof are one. The curved haunch (Fig. 3) is much more pleasing than the angular haunch (Fig. 2), which is a product of the "wood centering" style.

The logical type of ferro-concrete "style" is an arch or a vault that springs from the ground or floor, serving in its lower parts as wall, and in its top part as ceiling (Fig. 4). Now the arch which curves out gradually from the base to the crown is parabolic; near the base it is almost vertical, and it then curves more and more until at the top it approaches a semi-circle (Fig. 9).

Structural Advantages of the Parabola. Parabolic arches are economical; with a given load they require the smallest amount of material. The thrust curve of an arch carrying an evenly distributed load,—and that is the most frequent type of load in a building,—is a parabola. A parabolic arch can have a smaller section and less reinforcing than any other arch to support a given load. To quote from J. C. Austin: "The use of the principles of the arch, particularly in reinforced concrete, should be exceptionally well adapted to our structures. It is a fact that, generally speaking, no more than 37½ per cent of the concrete in a straight beam or girder is figured to resist compression, whereas close to 100

Fig. 1. The Planetarium of the Gesolei Exhibition, Dusseldorf

Fig 2. Lumber Storehouse, Kassel, Germany
K. V. Brocke, Architect

Fig. 3. Covered Lumber Court, Kassel
K. V. Brocke, Architect

per cent of the concrete in an arch is usually effective in resisting compressive stresses. The arch is one of our most economical structural units." Professor C. Korner recommended that vaulted halls be more frequently designed to follow a parabolic curve, because of all simple curves the parabola alone designates the vault of greatest stability, as investigations have proved. The designer of the Breslau *Markethall* (Fig. 9) chose the parabolic arch because it best approximated the line of thrust. If it be admitted that architecture is to a large extent the symbolic expression of the conflict of forces act-

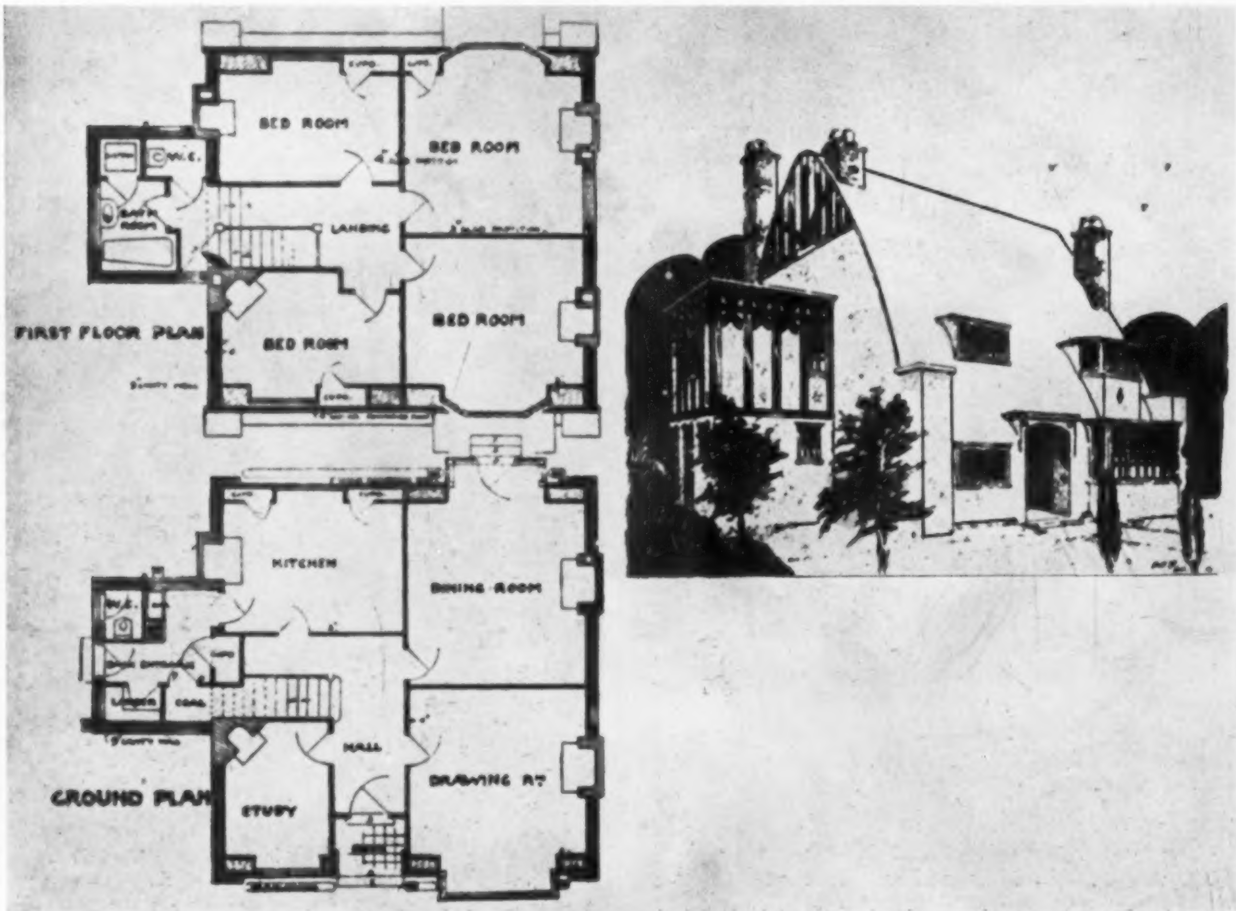


Fig. 4. A Ferro-concrete House in England

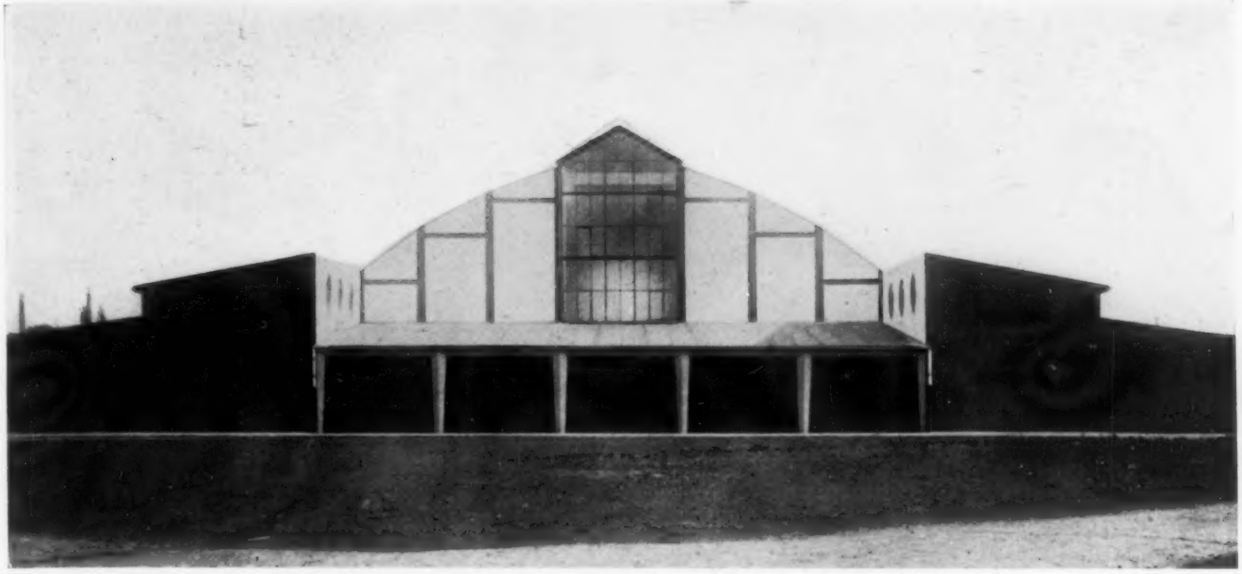


Fig. 5. "City and County" Hall, Magdeburg, Germany
Bruno Taut, Architect

ing in a structure, then the parabola is unquestionably to play an important role. The parabola can be called the resultant between gravity and a constant horizontal force. Gravity creates a parabola when drawing water earthwards, be it pouring from a horizontal spout or thundering over Niagara Falls; gravity creates a catenary,—a curve very similar to a parabola,—when acting on a flexible material of uniform weight, such as a chain or a ribbon. The arches of wood (Fig. 11), brick (Figs. 12, 13 and 14), and stone show that the parabola and similarly shaped curves are being utilized in modern architecture generally and are not restricted to the use of ferro-concrete. The engineer creating a bridge and the architect designing a lofty hall simply "listen in" to nature when they choose a parabolic arch.

The Æsthetic and Symbolic Value of the Parabola. Architects are inclined to disagree when the question of beauty arises. An object that is highly praised by some, is condemned as ugly by others. It will be therefore helpful to investigate the æsthetic qualities of the parabola. Greek art, generally accepted as the highest standard, created the sections of its mouldings as approximate parabolas, hyperbolas and ellipses; the echinus section of the Poseidon Temple in Pæstum, a half-parabola, is one example. The parabola is a curve of changing curvature,—according to John Ruskin a characteristic of all beautiful curves.

Theoretically the parabola is a curve that never ends,—one end of an infinitely long ellipse; comets follow parabolas through limitless space, and the parabolic arch gives the ferro-concrete style something of the infinite swirl and swing of the universe. To be "in tune with the infinite" has always been man's longing; but our age especially admires the great, the limitless. Lindbergh's flight enraptured mankind because he conquered space,—pushed forward the boundaries in man's struggle with the infinite. Technical achievements and records established at the Olympic games satisfy man's longing to extend his limits. The rhythm of rail and wire has already inspired poets and painters. The architectural expression of this new rhythm, of this urge toward the infinite is, I believe, the parabola—the curve that pays us a visit en route from the infinite

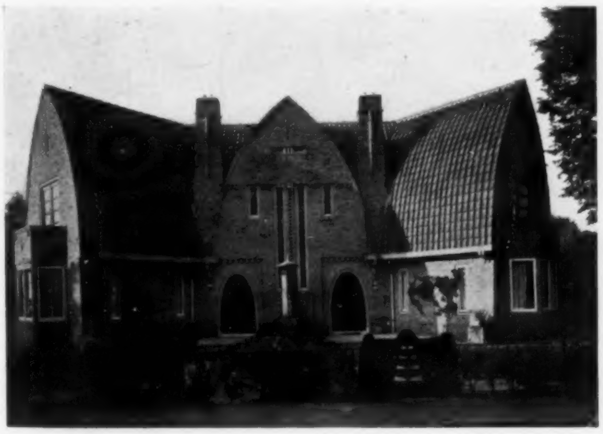


Fig. 6. Twin Villa, Hilversum, Holland

Fig. 7. Interior, Exhibition Hall, Magdeburg, Germany

J. van Laren, Architect

Fig. 8. A Reinforced Concrete Bridge in Sweden

to the finite. As Plotinus' philosophy claims, the apprehension of the infinite in finite figures can produce the impression of serenity. . . . "We have a longing born of the infinite and directed to an infinite desire of the soul which therefore never can fathom itself." We can call the parabola the emblem of man's life; one end here in the finite, the other hidden in the infinite-eternal,—for are we not like comets of hidden origin and unknown destiny? Professor Durant calls our life "our parabola through the world," and A. von Harnack writes: "But where and how the curve of the world and the curve of our own life begins,—that curve of which it shows us a segment,—and whereto this curve leads,—science tells us naught."

Pythagoras considered the realization of simple numerical laws as the source and the essence of the soul's satisfied pleasure in contemplating the beautiful and the true; the parabola's equation is simple. Plato recognized beauty as such in those simple geometrical figures which affect us not by material charm but as representations of spiritual concepts;

Fig. 9. Market Hall, Breslau, Germany
Eng. Kuster, Architect

Fig. 10. Congress Hall, Gothenburg, Sweden

and Plotinus says: "Always that is pleasing which expresses ideas as purely and perfectly as possible. . . . The beautiful object becomes beautiful through the dominance of the spirit, the dominance of the ideal over sensual matter, through participation with reason, which emanates from the divine. . . ." The idea shining through matter is the beautiful, according to Hegel. Another German philosopher, Theodor Fechner, applying these thoughts to the conical sections, called the parabola the symbol of love for the infinite and divine. He compares the focus to the soul, and the rays emanating from it to the periphery he compares to the endeavors of this focus-soul, adding: "The parabola is a serene symbol of love for an ideal, to the non-sensual, to all great and beautiful which,—only attainable in infinity,—entices the soul; all rays sent out by the parabola-focus run in parallel directions to the other focus in the infinite; all desires and thoughts are only directed thereto. On the other hand, no ray which did not emanate from the infinite can fall into the soul. . . ."

Examples. Several large halls which utilize the parabolic arch have been erected in Europe. The airship hangar at Orly consists of a series of parabolic arches connected by horizontal bars forming oblong windows between. The noted German architect, Professor Kreis, designed a pavilion for the

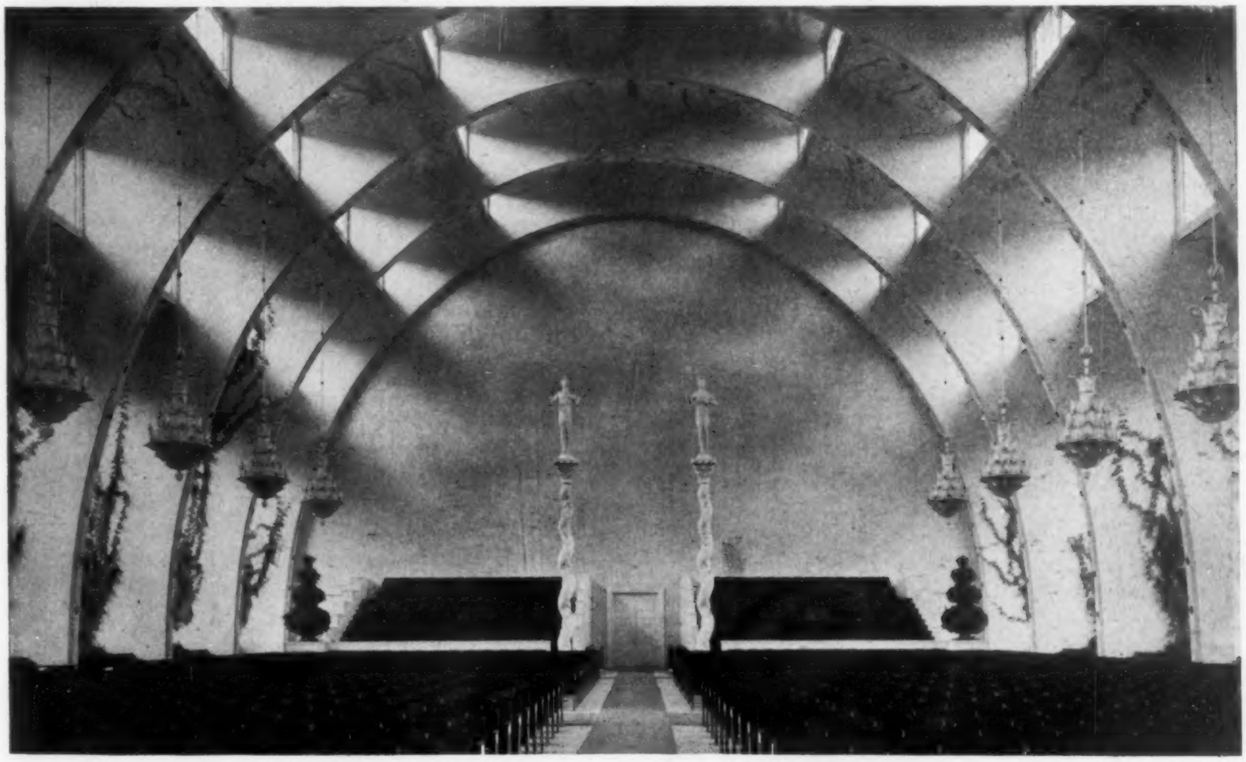


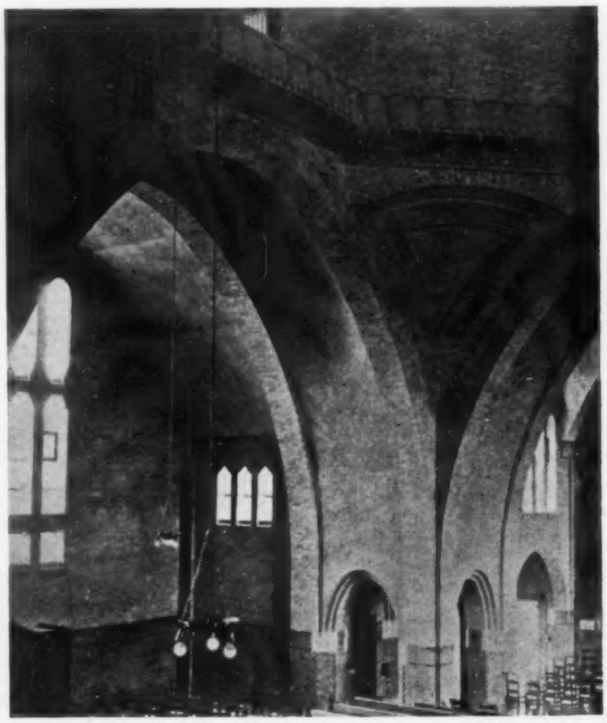
Fig. 11. Interior of Congress Hall, Gothenburg, Sweden

Munich *Farbenschau* featuring an arcade of parabolic arches which demonstrate the charm of unity possessed by that curve. In the interior of the Engelbrekt church, Sweden, Professor Wahlman has made use of the parabola in a group of arches supporting the roof over the four arms at the crossing. He explained that he desired to produce an effect of springiness, such as it seemed impossible to obtain otherwise. These arches are not of concrete, though other parts of the church are. The parabolic arches at the crossing of St. John the Divine, New York, are of huge granite blocks and designed to support a tower; it is significant that they have been incorporated in this otherwise mediæval design. The Congress Hall at Gothenburg, Sweden, is covered by a series of arches which support stepped-back vertical windows (Figs. 10, 11). In Holland the Utrecht Post Office, as well as several churches and apartment houses, has been built with approximately parabolic vaults or doors and windows (Figs. 12, 13). Two Catholic churches recently erected in Germany,—one by Professor Dominikus Bohm in Bischofsheim and the Pallotiner church in Limburg, by J. H. Pinand,—have parabolic vaults as naves. They demonstrate that not only Theodor Fechner sensed the parabola as "the curve of idealism"!

Details of Execution. Parabolic doors can be arranged as sliding or as revolving doors. Parabolic windows can receive an upright center-post, around which two wings turn on hinges, while the upper segment turns around a horizontal transom bar. The almost circular segment at the crown of the parabola admits more light and air than the point of the Gothic arch. When still more light near the ceiling is needed, the spandrels could be pierced and filled with tracery or vertical posts as seen in so many bridges (Fig. 8). The inclined lower portions of the parabolic arch seem to be an obstruction. This may be just prejudice.

Fig. 12. Shops, Hilversum
J. van Laren, Architect

Editor's Note. This article was prepared by the author from his book, "The Ferro-Concrete Style."



Figs. 13 and 14. Interior of Church at Nijmegen, Holland
H. Thunnissen, Architect

BETTER STUCCO HOUSES

PART II

BY

ARTHUR C. ALVAREZ

ASSOCIATE PROFESSOR OF CIVIL ENGINEERING, UNIVERSITY OF CALIFORNIA

UNDER this title in THE ARCHITECTURAL FORUM for August, 1928, the writer called attention to the widespread and increasing use of the timber-framed stucco house because of its many architectural possibilities, ease of construction and comparatively low cost, and he alluded to the great economic value of improvements in structural design whereby its safety in severe earthquakes and hurricanes would be assured and its life under the harsher weathering agencies, such as excessive freezing or rain, greatly prolonged.

The type of structure under consideration is the dwelling of three stories or less in height. In the preceding article, the chief structural factors involved in the selection and preparation of the site and in the design and construction of the foundation and underpinning were presented. The present and a subsequent article will continue to deal exclusively with questions of structural design involved in other parts of this type of building, such as the framing, chimneys, stucco covering, roof covering, openings, all considered from the point of view of increasing the building's resistance to the hazards already mentioned. These questions should be of special interest to architects, because very great benefits are to be derived from giving adequate attention to details of structural design, rather than leaving the matter to the carpenter in charge, as is too often done.

Framing. When the height of a building does not exceed two stories, two methods of arranging floor joists and wall studs are possible,—(1) "balloon" construction, and (2) "story" construction. In balloon construction the studs of the outside walls are continuous from the sill of the concrete foundation to the plate on which the rafters rest. In story construction the frame is erected one story at a time, the continuity of the studs being interrupted at each floor level by wall plates and floor joists, as illustrated in Fig. 8. Balloon construction is not feasible for a structure of more than two stories because of the excessive lengths of studs required, and because the cost of erection would greatly exceed the cost of erection by stories. After describing the two types of construction, their relative merits will be discussed. Erection by stories is employed much more extensively than balloon construction, because it is very much easier to execute from the contractor's point of view.

Framing of Floors and Walls in Story Construction. Floors. Referring to Fig. 3, on page 268, THE ARCHITECTURAL FORUM for August, 1928, the joists *fg* at all floors and roof should be anchored very securely to the plates, *EF, AB* and *GH,* rather than be merely "toe-nailed," a common practice, which produces a very weak joint. The structural advantages of such adequate anchorage in case of earthquake or hurricane are obvious. A very effective joistplate joint can be arranged by using a 2 by 6-inch pine splice about 2 feet long, as shown by *e* in Fig. 3, and by *e* also in Fig. 8 of this article. To prevent splitting, the joist should be drilled for four 20-penny nails, properly staggered from joist to splice, and the splice should be drilled for four 20-penny nails to the plate. Thus all nails are arranged with reliable bearing so as to develop their lateral strength in the most effective manner, because at the junction of any two pieces of timber the forces act perpendicularly to the axes of the nails. Wherever great tenacity is required in a nailed timber joint, the designer should arrange the nails and timbers in a similar manner.

In order to insure lateral support, all the joists should be solidly bridged with 2-inch pine, extending from the tops of the splices to the tops of the joists, along all supporting plates, as in *EF, AB* and *GH.* At the outside walls, this bridging should be placed just inside the inner line of the wall plate; it will then serve as a header for nailing the ends of diagonal floor boards, which should be run just to but not under the plate. Vertical shrinkage in the floor boards will then have no effect on the stucco. The cross-bridging of joists, as along lines *JK* and *LM* in Fig. 3, is needed to stiffen the floor. This it accomplishes by distributing any concentrated vertical load to at least three adjacent joists, provided the distance between lines of bridging does not exceed 6 feet, approximately. Such cross-bridging would be much more efficient than it frequently is if it were made 2 by 4 inches in section instead of 1 by 4 or 2 by 3 inches, if care were taken to miter the ends of cross-bridging accurately against the sides of the joists, and if the pieces were drilled for two 12-penny nails at each end instead of being rendered practically valueless because of splitting by driving in two 10-penny nails. The 1 by 6- or 1 by 8-inch flooring boards should be laid at an angle of 45 degrees with the sides of the house; two 8-penny nails at each joist are sufficient. Where the floor plan is unsymmetrical, or the floor area is unsymmetrically loaded, earthquakes tend to twist the entire frame about some vertical axis. When the walls are thoroughly braced, diagonal floor boards are of greater assistance than floor boards at right angles to the joists in developing resistance to such twisting. Diagonal floor boards are more effective also because of the bond they produce between walls and partitions that meet at right angles.

Walls. All studs should be spaced not to exceed

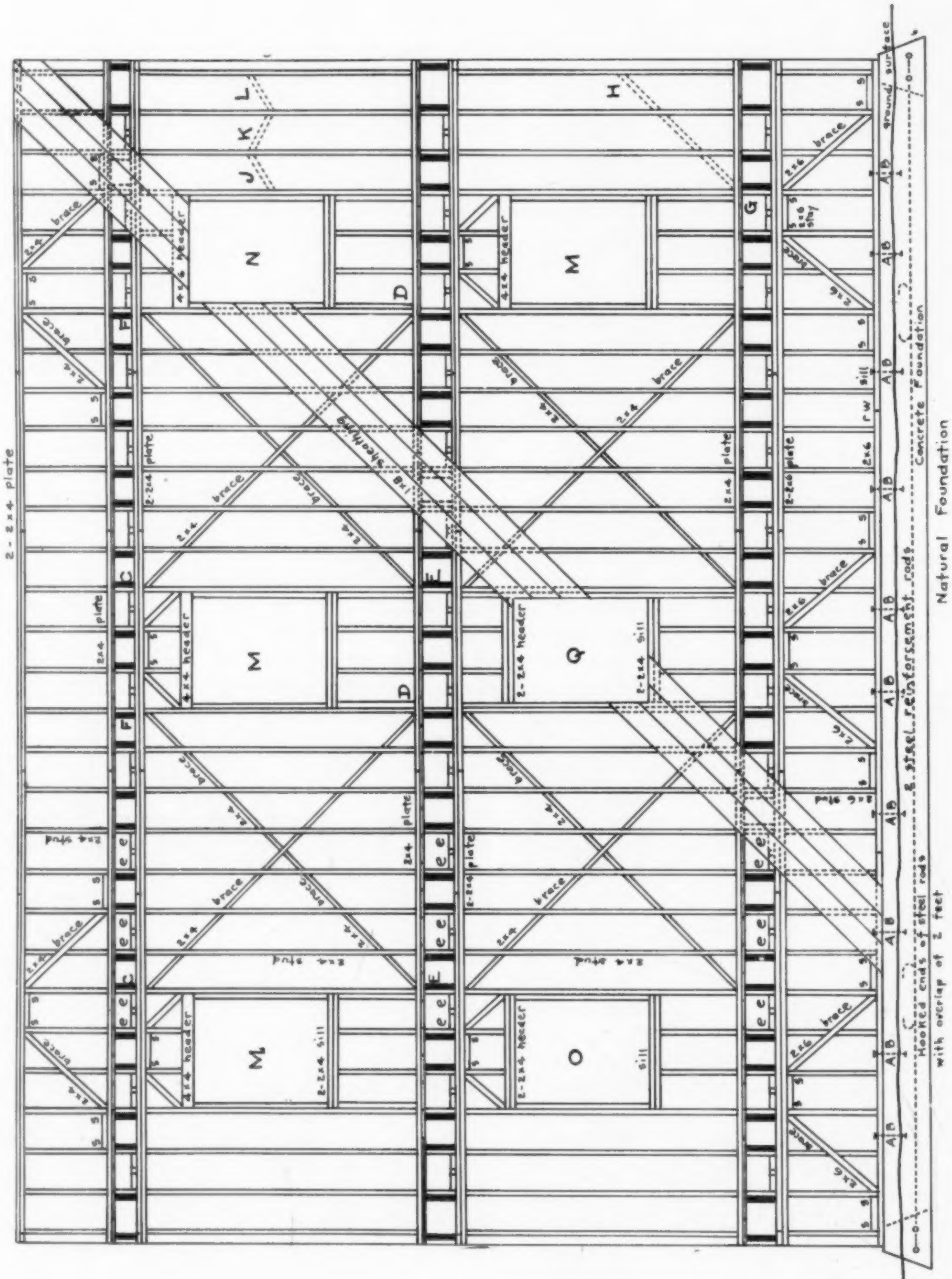


FIG. 8. CONSTRUCTION DETAIL OF THE ELEVATION OF A WOODEN FRAME BUILDING

16 inches. In buildings of one or two stories, 2 by 4-inch studs throughout are sufficient, except that the underpinning of a two-story house should be composed of 2 by 6-inch studs; for three-story structures, 2 by 6- or 3 by 4-inch studs should be used in the first story as well as for the underpinning. Size 2 by 6-inch is preferable to 3 by 4-inch, because there will be relatively less injury when the studs may be notched for plumbing pipes. The upper plate of every story should consist of stud-sized timber, doubled; this facilitates lapping at corners and makes possible long, well nailed overlaps for all straight splices, as shown in Fig. 8, page 746. In each side of each story there should be at least two lines of stud-sized diagonal bracing sloping in each direction, as *CD* and *EF* in Fig. 8. To be effective, this bracing should make an angle with the horizontal not greater than 45 degrees; the smaller the angle, the more effective the bracing, but the line of every diagonal brace should extend continuously from floor plate to ceiling plate, because a brace like *GH* in Fig 8 is only about 40 per cent as efficacious as a brace like *EF*. In the stories above the underpinning, it is better to fit the sections of a diagonal brace between the studs, as shown in Fig. 8, than to cut a great number of studs in order to make the diagonal brace one continuous timber. Stays will then not be necessary at the ends of the diagonal brace which terminate at the plates. Some designers advocate letting into the studs a 1 by 6-inch diagonal brace, but the writer prefers fitting in between the studs the sections of each brace, as just described, because the letting-in involves more tedious carpentering and unnecessarily reduces the cross-section of the studs braced. The studs should not be "toe-nailed" to the plates. Instead, two 20-penny nails should be driven into each stud through each plate; at its ends, to avoid splitting, the plate must be drilled for these large nails. At intervals, 20-penny nails should be driven through the single-stick lower plate to the floor joist system below. At all corners the end studs of both walls should be securely nailed together by 20-penny nails. The sections of diagonal stud braces should be drilled to receive two 12-penny nails at each end, otherwise serious splitting will occur. Depending on the height of ceilings, one or two lines of stiffeners, like *J, K* and *L* in Fig. 8, are necessary where diagonal sheathing is used, because these support the studs laterally against the shrinkage stresses developed when the sheathing dries, and thus reduce the possibility of there being cracks in the stucco. Such stiffeners are necessary also in all partitions. The individual sections should be mitered in, so that wedging action will make the joints very tight. Whenever walls or partitions meet, the opportunity should never be neglected to attach continuous studs in each with 20-penny nails. The drilling to prevent injurious splitting of all such pieces as sections of diagonal braces, stays on underpinning plates, joist-plate splices, joist cross-braces, wall stud stiffeners, etc., can be done at low cost by an apprentice carpenter with an electric drill; in the opinion of the writer, it is well justified by the increase in structural integrity thereby imparted to the frame. In the preceding and following descriptions, for simplicity of statement, only "rough" sizes of timber are given, since these are sufficient for structural purposes. Of course all architects are aware of the necessity of the special sizing required to make all such members as joists, studs, plates, rafters, floor boards, sheathing, etc., of uniform dimensions.

Framing Openings. So simple is this matter that no mention would be made of the subject were it not for the fact that the writer has often seen openings framed as poorly as that shown at *Q* in Fig. 8, where the header, which takes considerable loading from the floor above, is supported only by "toe-nailing" at its ends, instead of being supported positively in the manner shown at *M* and *N*. The ends of the sill also should be positively supported, as shown at *M* and *N*, rather than be merely nailed, as at *O* and *Q*. A single-piece header, as at *M*, because it is stiffer, obviously will support more load than the two-piece header of the same size at *Q*. The trussing above the header at *M* affords a much stiffer frame than the use of merely a deeper header, as at *N* only if the diagonals are well fitted and the center stay is snugly wedged into position. For wide openings, if headroom permits 45-degree angles for the diagonals, trussing is preferable to a very deep joist header, because the shrinkage and time sag in the joist header, by withdrawing support from the floor above, will cause cracking of the stucco and interior plastering. In hurricane areas, very substantial shutters must be provided for all glass openings, because it is doubtful if even small panes of heavy glass in heavy metal casement frames could survive the impact of all the debris flying in the air during a storm. If the architectural design permits, rolling steel shutters are very efficient and, when not in use, may be completely concealed. If wooden hinged shutters are employed, the fasteners and hinges must be of heavy wrought metal attached by bolts, not screws, and the hinges should be bolted, not to the sheathing, but through stucco and sheathing to wall studs set for the purpose.

Framing of Floors and Walls in Balloon Construction. Except where openings for windows and doors occur, the studs are continuous from the foundation sill to the roof plate. The studs in any one wall are held at their proper spacing, 12 or 16 inches, just below each level of floor joists, by a 1 by 6-inch ledger board, which should be let into the studs on their inner sides so as to be flush and fit closely, and it should be securely nailed by at least two 10-penny nails to each stud. A ledger board acts as a sill for the joists. The joists should be notched to a depth of 1½ inches over the ledger board and should be securely nailed to the studs by the use of at least three 16-penny nails at each joint; this anchors the joists very effectively to the outside wall framing at

each floor level. The top ceiling joists should be similarly anchored and should be continuous clear across the building so as to hold together the tops of opposite walls. The continuity of the studs in the outside walls, however, is not sufficient to give these the lateral rigidity necessary for resistance to strong winds, not to mention hurricanes or earthquakes. To obtain this rigidity, the studs in each wall and story must be diagonally braced in the manner previously described for story construction.

Balloon Construction Versus Story Construction. In order to reduce carrying charges, lumber is moved nowadays with the greatest possible speed from sawmill to contractor, with the result that the timber goes into the frame long before it is adequately seasoned to prevent shrinkage. So it dries and shrinks after it is placed in the building, and, unless provision is made to counteract this shrinkage, it causes very serious cracking of exterior stucco and interior plaster, which often involves considerable injury to costly interior wall decorations. It is well known that, when timber dries, it shrinks longitudinally very much less than it does across the grain. For example, in a building consisting of two stories and basement, the total vertical shrinkage in the outside walls is much less, if the studs are continuous pieces as in balloon construction, than it is if the studs are interrupted at each floor level by joists and plates, because, in drying, green joists and plates will shrink very much. But such joist shrinkage can be counteracted easily without resorting to balloon construction, as will be explained presently. Theoretically, the chief merits of balloon construction are three in number: (1) Structural continuity between stories. (2) Minimum vertical shrinkage in the framing of the outside walls. (3) Convenient spaces for running plumbing pipes from story to story in the outside walls without injury to the frame.

If all the walls of a building were blank walls without openings for windows and doors, balloon construction could be framed very correctly and simply; undoubtedly there would be structural continuity between stories, and the vertical shrinkage occasioned by drying of the continuous studs would be much less than in story construction. But in practice there are some serious disadvantages in the use of balloon construction, as will now appear. Since all houses have numerous openings of various widths in different stories, and since these openings do not necessarily come vertically above one another, and since in many houses the walls of any one side frequently do not lie in the same vertical plane at all stories, frequently only a small fraction of the total number of studs in outside walls can be run through from concrete to rafters in practice, in fact in some designs too small a fraction to make the attempt worth while. Furthermore, in balloon construction it is more difficult effectively to truss the headers above openings, so that sags in the framing above the openings will not occur. Such sags will crack both stucco and interior plastering. Since the irregular location of the openings dictates the position of many of the studs, many extra studs must be introduced in balloon construction to provide at regular intervals for the lateral support of the floor joists. In balloon construction the size of studs in an upper story cannot be reduced without introducing a wall plate 4 inches deep at the break; also, along the walls in which the ledger board is placed, a separate header must be inserted between the floor joists near the inside face of the studs, to support the ends of the floor boards, when they are placed diagonally. Again, since the interior partitions in the several stories ordinarily do not come vertically above one another, it is not possible to apply balloon construction to them, so that, if ballon construction is used in the outside walls, there will be a differential settlement caused by the shrinkage of the joists supporting the interior partitions. This differential settlement will crack the interior plaster at the corners of rooms and in the walls that are perpendicular to the outside walls, and will cause great damage if expensive wall decoration is marred.

If the shrinkage in the outside wall at the joists could be eliminated from story construction, this type of framing would be preferable because of the simplicity of erection from the contractor's point of view and because the details of the framing in various stories can be arranged independently with greater ease. The elimination of this shrinkage can be accomplished in two ways,—(1) the studs of any one story may be run down alongside the floor joists of that story directly to the ceiling plate of the story below; (2) separate uprights of stud size may be adjacent and nailed to the joists wherever the joists rest on the plates of the outside walls or interior partitions, as shown by the sections in solid black in Fig. 8. This amounts to introducing a row of dwarf studs whose height is just equal to the depth of the floor joists. When the joists have shrunk, these dwarf studs will transmit the wall load from floor plate to ceiling plate, and thus prevent the shrinkage of the joists from cracking the stucco. The latter method is preferable to the former. The only remaining possible sources of considerable shrinkage in the frame are the ceiling and floor plates and where interior partitions of different stories do not lie in the same vertical plane, for then the dwarf studs are of no avail. If special care is exercised to get well seasoned plates, the shrinkage from this source should not be a serious matter. If the exterior architecture involves a half-timber design, an exposed timber belt course, interrupting the stucco at the level of the joists, will automatically allow for shrinkage in the plates. But in neither balloon nor story construction is there a simple way of overcoming the effects of shrinkage where interior partitions do not lie in the same vertical plane, excepting by the use of kiln-dried joists, because it is usually not economically feasible to run the studs of interior partitions down to a metal plate support at the bottom of the

joists. The equivalent of whatever continuity occurs in balloon construction in practice may easily be obtained in story construction by the use of timber sheathing diagonally laid at 45 degrees. Therefore, in the judgment of the writer, all factors being considered, construction by stories, with the modifications suggested here, is preferable to balloon construction. Erection by stories is used almost exclusively through the Pacific coast district.

Sheathing. Tests made by the writer on numerous wall panels at the Civil Engineering Laboratory of the University of California, and published in the *Bulletin of the Seismological Society of America,* December, 1925, under the title "Wall Bracing in Timber Frame Buildings," showed that when 1 by 8-inch sheathing was nailed solidly to the studs at an angle of 45 degrees with the horizontal, instead of horizontally, the resistance of the wall to earthquakes and hurricanes was increased about 40 per cent, provided the studs were braced also by diagonal stud braces, as shown in Fig. 8. Since such diagonal sheathing bonds the framework of the several stories and the underpinning to such an extent as to cause the entire building to act as a unit, it is strongly recommended wherever resistance to earthquakes or hurricanes must be considered. There should be two 8-penny nails in each 8-inch board at each stud, at each floor and ceiling plate, at each diagonal brace, and particularly at the bolted foundation sill, because diagonal sheathing, as already said, is very effective thus to anchor light timber frame buildings to their concrete foundations to prevent dislodging by a hurricane.

The tests mentioned also indicated that the use of 10-penny nails in the sheathing in place of 8-penny nails did not appreciably increase the resistance of the panels. Diagonal stud bracing should never be omitted simply because the sheathing is attached diagonally. In addition to stiffening the wall, the diagonal stud bracing that lies at right angles to the direction of the diagonal sheathing helps to prevent cracks in the stucco due to shrinkage of the sheathing. End joints in the diagonal sheathing, if required, should always be made on the studs, at points between but not at floor levels. If the end joints in the diagonal sheathing are made at the floor levels, a great opportunity to tie the frame together very securely is lost. At outside corners, the diagonal sheathing should be lapped so as to afford maximum nailing area in the boards for attachment to the end stud of the adjoining wall. Tenacious corner ties between walls are very essential for resistance to earthquakes and hurricanes. It does take a little more labor and material to nail sheathing diagonally than horizontally, but the structural advantages are well worth it. The tests mentioned here also showed than horizontally, but the structural advantages are pended on the diagonal wooden sheathing; the other half came from the diagonal stud bracing. Therefore, where resistance to earthquakes or hurricanes is needed, such wooden sheathing ordinarily should not be omitted, unless a very thick back-plastered Portland cement stucco is used in connection with special heavy reinforcement. Nor should any weaker substitute be used in place of the wooden sheathing, because not only will the rigidity of the wall be diminished, but, because of deterioration in time, such substitute may become a less desirable base for the stucco, which for permanence requires, among other features, a very substantial, immovable base.

There can be no doubt about the relative merits of diagonal and horizontal sheathing, so far as structural advantages are concerned. But their relative merits as a reliable base for the stucco should also be considered. Tests conducted under the auspices of the United States Bureau of Standards seem to indicate that cracks in stucco are likely to develop around window and door openings where green diagonal sheathing is used. This is true probably, because the studding is less able to offer lateral resistance to a 45-degree pull due to the shrinkage of the diagonal sheathing, than it is to withstand a vertical compression such as occurs when horizontal sheathing shrinks. The distortion of the frame occasioned by the shrinkage of diagonal sheathing, nailed on green, would naturally be evidenced by radial cracks at diagonally opposite corners of openings. Such cracking of the stucco can be avoided by using only well seasoned sheathing and many diagonal stud braces placed perpendicularly to the direction of the diagonal sheathing. The type of metal mesh reinforcement also plays a most important role in stucco crack prevention, but this will be discussed in a subsequent article. Even if the sheathing is horizontal, when green boards become seasoned, they will either shrink and pull the nails with them, or, if firmly held by the nails, they will split; in either case there is movement of the base under the stucco,—a very undesirable condition. The writer has seen much stucco remain in good condition over seasoned diagonal sheathing, but adequate seasoning of the sheathing is of paramount importance in preventing cracks in stucco and should always be insisted upon.

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THE ARCHITECT AS CONSTRUCTOR

BY

JOHN TAYLOR BOYD, JR.

IS it desirable for an architect to undertake construction work? This is one very important question for the profession of architecture. It is not a new question, as Wilfred W. Beach points out, in his excellent articles on the subject, in THE ARCHITECTURAL FORUM for May, August and October, 1928,—but the constant evolution of the profession brings new factors into the situation, which necessitate considering it anew. One may agree in large part with Mr. Beach's views (although not subscribing to some of his strictures on the ways of contractors). Nevertheless, the question is one for each individual architect to decide for himself, according to his own talents and the circumstances of his practice. The type of competition he is likely to meet from contractors is also pertinent. The subject is most complicated, and there is more to it than both Mr. Beach and I can cover in a few articles. In reading Mr. Beach's words, one gets the impression that he has considered the matter having chiefly in view practice in smaller centers and in smaller buildings. My own views, on the other hand, come from experience in large construction operations in a large city; and in presenting these views, I believe it worth while to emphasize two very important factors. These are (1) the financial aspect, usually a governing factor in business affairs, and (2) the background of economic conditions, which although somewhat intangible, is likely to be, none the less, a determining influence, over a period of years.

The type of practice is all-important. Is it a specialized or a general practice? Since the war there has been a great increase in the tendency among architects toward specialization, and authorities hold that this tendency is in accord with economic trends. Is the practice located in a great city or in a smaller center? In what region of the United States is it? The answers to these questions must influence strongly the decision of the architect who branches out into construction.

One's personal experience colors one's views, and for this reason it may be well for me to describe my own contact with construction. After several years' experience in architectural offices of the conventional type, I served for about six years as one of four principal assistants in an architect's organization, engaged in a fairly large specialized practice, which, by letting sub-contracts direct, constructed a large part of its own designs to the amount of several million dollars' worth of buildings in its most active years. It was a very broad and a very detailed practical experience. It led me to conclude that there are some great advantages, not many disadvantages, and a number of great difficulties, in an architect's undertaking construction.

The Ethical Question. Before entering upon discussion of these, however, there is first to be considered the question of ethics. It is not necessary to quote authorities to uphold Mr. Beach in declaring that, even in the formal regulations of the A.I.A., there is nothing to forbid the practice, *provided* that the architect carries on the activity according to professional ideals, as distinct from commercial ideals. Everyone knows what this distinction is. More specifically, while the Institute will not permit the architect to become a "lump-sum" contractor, it allows him, as owner's representative, to place subcontracts on the basis of a fee for his services, which are professional. Under such conditions, the architect takes over an important part of the functions of the general contractor,—not all the general contractor's functions, however, when these relate to financial guarantee of costs or to financing the operation.

There is, nevertheless, a more intangible but no less important question involved in this question of ethics. "Will not the responsibility of construction be detrimental to art?" asks the doubter. It should not be detrimental to art any more than the existing conventional method is, as seen in a large part of professional practice. Too often, art, to say nothing of high standards of design, which do not quite reach the level of art, is secondary to business. By "business," I mean the usual activity of making contracts, of getting commissions, and a variety of promotional activities, from studying real estate trends, rentals, site values, locations, mortgage conditions, acquisition of a moneyed following, and the forming of syndicates, to the putting through of deals, and the scheming out of ways of financing building operations. This, of course, is a rather damaging answer to the accusation, I fear. It will shock many people on both sides. It will inflame the old school practitioner whose practice lies in the fields of public, domestic, ecclesiastical and institutional architecture where, ordinarily, finance does not affect the architect, and it will disappoint my good friend, C. Stanley Taylor, who rather advocates this business activity. Mr. Taylor would reply that business should not necessarily injure art. Unfortunately, it very often does, if the opinions of a number of observers of architectural practice in New York have any value. So I fear that this important side of the question must be left undetermined for the present, except for a few pertinent observations. The art side is always paramount in architecture, otherwise by definition architecture disappears. If it neglects art, the profession of architecture has no valid excuse for existence. Let us, furthermore, do away with "bunk" and sentimentality. We must recognize that the constant preoccupation with business matters, which is often necessary to provide a steady volume of new business to keep going many large,—and

many small,—architectural organizations, has the effect of crowding out art, as well as of developing a view point which is antagonistic to professional progress. The pressure on the architect tends to make him view architecture through the eyes of the real estate broker, promoter, or speculator, whose understanding of business and economics, in turn, may be one-sided,—that of a trader and salesman, not that of the more analytical "constructive" producer who is coming more and more to guide the modern American economic organization. When he holds this point of view, the architect tends to become an opportunist. On the other hand, construction is more closely allied to art than is business, and it reëstablishes the architect in the old role of master builder. In any case, it is well to bear in mind the observation which Julian Clarence Levy makes in these frequent discussions of the ills that beset the profession: "Most of the troubles which arise in professional practice are due to the fact that architecture is at once an art, a profession and a business." Perhaps the only conclusion to be drawn as to this phase of the matter is that American architecture must reach a higher level of art and design if it is to maintain its high standing.

Duplication of Function. To come to the heart of the question of architect versus general contractor, it seems clear that, in practice, there exists a real overlapping or duplication of function as between the two. The pressure of modern economy is to do away with this expensive waste effort. My direct observation of the methods of several large general contractors, and my knowledge of New York building customs, convince me that this duplication is serious. The general contractor claims (1) that he plays a necessary role in a building operation because he possesses a concentrated, exact knowledge of structural details likely to exceed that of the architect; (2) that he handles the huge mass of details of administration to best advantage; and (3) that he provides the necessary financing of the actual erection. In theory, he alone can best carry out these three functions, and hence he is entitled to an undisputed place in the economic organization. Let us see how this claim works out in practice.

The Organizations Compared. I have observed that the organization of an architect who has a large specialized practice in one or two types of buildings is likely to be more expert in its construction details than the organization of a large general contractor who builds all kinds of structures and who is rarely so specialized. I know that this is contrary to the impression spread by an active propaganda, which pictures the architect as "impractical." Actually there are good reasons for my belief. The old style builder, the man who really knows construction as only years of driving nails and laying bricks "on the job" can teach it, the true craftsman builder, the man who can really give to the most practical architect and draftsman points,—this old time character is passing from the great general contractors' office organizations. He is being replaced by executives and office workers of a different type; by men who often know less about construction details than do the men in the architects' organizations. Some of these contractors' men are called engineers, but actually their chief claim to this title is a degree from a professional school of engineering. They have hardly the practical experience which entitles them to be ranked with the old time builder. Even their engineering education has much less specific bearing on building than has the corresponding training in an architectural school. After graduation, these contractors' office men may get a few years' experience in office administration, in work in a field office on a large construction project,—in other words, work of a general character on a variety of building. This can hardly approach the specific, practical value of the experience gained by the graduate of an architectural school in an architect's office, who perfects his structural knowledge in years of planning, detailing, correcting shop drawings, of one type of building. Even more, others in the great contracting companies may lack even the advantages of a vague engineering education. One finds accountants, lawyers, traders, contact men, salesmen, good fellows who have none too practical a knowledge of construction details. Experience and practice teach them much, no doubt, but they often know less than a good architect's man, and very much less than an old time builder, particularly in the vital matter of costs. No one can know costs quite so well as the craftsman-foreman, who has had years of daily experience as a workman, in handling workmen, solving erection problems, and in purchasing materials. After all, the best man in construction work is the man who can "buy the job." This fact should never be lost sight of. My experience is that it is rarer than good administration.

The old time builder no longer dominates many an important construction company. More and more he tends to gather in the ranks of the subcontractors. There he is doubtless more effective, because his concentration on construction tends to unfit him for complicated administrative duties. Of course, there are many fine contracting companies where the simpler organization, comprised of experienced building men, still exists. The chances of an architect's competing successfully with them lies in the advantage of detailed experience gained in a specialized practice. The less successful organizations have many of the weak points listed by Mr. Beach.

The effect of this diminishing expertness in structural matters in a contractor's organization is marked. It piles up a clumsy administration with an expensive salary list, which makes the general contractor a none too efficient intermediary between the architect's office and the subcontractors'. The general contractor's office often seeks to shift its responsibilities to the architect's men. It particularly fails to coöperate with the architect's office in checking. Often this is due to no lack of good will, but rather to insufficient knowledge of building construction. I have observed

that plumbing, heating and other mechanical details are frequently mismanaged by general contractors, so much so that many architectural offices of the conventional type let these subcontracts direct in order to save trouble. Therefore, the direct method of dealing with the subcontractor does not add to the architect's difficulties as much as might be supposed. I well recall the sensation of positive relief in my first experience of the direct method. It was as if a veil had been suddenly lifted between myself and the subcontractor,—the man who actually put up the building.

As regards the second function of the general contractor, that of undertaking necessary administrative functions, it needs little further argument to show that if the contractor's men are less expert than either the architect's office or the "subs," his claim to be of service is less valid. The contractor's man is less helpful than would be a good building man in an architect's organization, rendered more expert by a specialized practice and by dealing constantly with designers. In certain classes of buildings of a complicated character, having a mass of special interior details, such as a country house or a hotel, the architect's office must perform in any case a formidable amount of superintendence, and but little added effort is necessary in order to make this superintendence include erection as well as inspection. Particularly unsatisfactory, in most cases, is the employment of a clerk of the works. Having myself performed that function many years ago, I can testify that it is often a fifth wheel,—a bird without wings. When an architect goes so far in adding expense, why not go the whole way and make the clerk of the works a real construction man?

Financing. The third function of the general contractor,—namely, financing,—is difficult to appraise because it varies so extensively in practice. I suppose that most architects have known cases where the general contractor contrived to shift this burden to the subs as much as possible. He did this either by inducing them to accept notes, or else by delaying payment on requisitions after the architect issued his certificates. In New York, among builders of the more speculative "shoe string" type, this practice is being condemned by organizations of subcontractors and material men. It is claimed that the subcontractor is the real speculator in the deal, without having the compensating advantage of a voice in the business. This phase, of course, opens up another and very complicated side of the situation,—that of finance. As everyone knows, the financial side of contracting is always becoming more important. It presents perhaps the greatest obstacle to an architect's engaging in construction. In many cases, the builder's control of capital may be his greatest weapon in competition. The offer of a large subscription to the capital stock in a great proposed new building, or willingness to take a second mortgage, may be worth more to an owner than would be a saving in cost per cubic foot on a straight construction contract. What the owner loses on erection cost, he more than makes up on lower premiums for capital. In these cases the contractor becomes a speculator or investor in the building.

The architect can hardly go as far as this, although, as mentioned previously, he has, in many cases, already gone pretty far in promoting and in attracting a moneyed following. Thus, commissions are sometimes awarded to an architect mainly because he can interest his following in subscribing part of the money required by the syndicate undertaking a building project. In addition, the architect himself may accept part of his fee in preferred stock, second preferred, or common stock. The speculative method of financing which, to greater or less degree, underlies most real estate, leads naturally to such practices, and the individual is obliged to cope with them as best he may, according to the particular circumstances of his personal situation.

This summary of the duplication of functions between architect and general contractor suggests that much duplication exists in certain instances in the three chief functions of structural expertness, administration and financing, which the general contractor undertakes to perform. It indicates that the architect, particularly the architect of specialized practice,—and the trend of the day seems clearly to be towards "specializing,"—has good reason to believe that he is better fitted in many ways to undertake these functions than the contractor is. The chief obstacle is the financial power which many contractors wield in being able to supply capital for an undertaking.

The Economic Element. Nor should one overlook the basic economic element in the question. The economic and industrial development of the United States proceeds at an amazing pace, with bewildering changes. Its goals seem to be specialization, integration, volume production, efficiency. These changes bring gigantic success or overwhelming disaster to any industry, according to its ability to adjust itself to economic changes. The automobile industry and the coal industry are cases in point. It may not be enough to wait until the changes arrive,—it is better to anticipate them, if possible. All this may sound vague, but I have felt for some years that the architectural profession would do well, for its own security, to recognize that point of view. Viewed purely as a profession, architecture can scarcely avoid being affected by the profound movements in American industry; and, to the extent that it is a business, it should be still more prepared for changes in business conditions. More specifically, the profession should, I suggest, consider these possibilities:

(1) Large scale operation, not merely "big" single buildings, but construction by blocks, areas, districts. How otherwise can the modern city develop efficiently?

(2) Elimination of speculative methods, which involve small-scale operation and high costs.

(3) Low costs, to which sounder financial methods

will contribute most, as financing is a large factor.

(4) Prevention of inflation of site values, which cuts down the market for buildings.

All these factors are bound up, one with the other. Strange as they sound to some ears, it will be observed that they express nothing but the accepted doctrines of Big Business. Is it not reasonable to think that they will eventually have an effect on real estate and building?

The Organization Necessary. Turning from these general considerations, the matter of next importance is the type of organization needed by an architect who embarks in construction work. The architect should not copy the expensive, none too efficient organizations found in some of the largest construction companies. His office construction force should be modeled more after the old builders' administrative nucleus; two or three executives who knew construction, with the aid of a bookkeeper and stenographer or two, renting an office of two or three small rooms, handled easily several large projects at once. The architect would do well to add to his office force a designer of structural steel and concrete. This man should spend most of his time in the drafting room, working side by side with the designers and draftsmen, where he can witness a building conceived, born and brought up, lending invaluable assistance to the process. Such a man may be more valuable than one working in a contractor's or consulting engineer's office. He need assist the builders only occasionally, with a little advice, or by undertaking occasional superintendence of complicated foundations or structural details, although generally the builders can administer these. One builder-executive is usually enough. His function is to let contracts, with the occasional assistance of the drafting room in checking and in estimating. Estimating quantities of materials is not difficult. The executive is helped by the specification writer in drawing contracts. With an "outside" construction superintendent, this executive administers the construction work. He needs comparatively little assistance from the accounting department.

As to the stumbling block of mechanical installations, that is not serious in the hands of experienced building men who are constantly engaged in construction of the same one or two types of buildings. As noted, it is admittedly a serious defect in general contractors' organizations. A man who has erected the same type of building 20 times has little to learn about plumbing, electrical and low-pressure steam heating installations from an expert in a general contractor's organization who may also have built 20 buildings, but each of a different kind. Actually, the average building has little that can be called real, professional engineering in it. Sometimes I think we architects fool ourselves by using the word "engineering" in connection with buildings. What is really involved is *purchasing*. The rest is chiefly a draftsman's work. On buildings, a man may have an engineering education, but that does not mean that he acts in a true engineering capacity, as he would in erecting a bridge or a factory. In the average building, the construction man may need, at most, a few hundred dollars' worth of advice on sizes and specifications of mains in piping, details of valving, etc., around tanks, heaters and boilers, as well as some electrical details. This information is supplied also to the drafting room and to the specification writer; and, since costs are paramount, this information may be best obtained by selecting some keen young man in a subcontractor's force or a supply house, dealing directly with him as an independent expert.

The architect's field organization should be likewise simple. Each project has a construction superintendent who reports to the "outside" construction superintendent, and who has the usual clerical and other aid, depending on the size of the undertaking.

In all this discussion of organization, close personal contact and coöperation are essential to efficiency. In any operation so complicated as that of producing a building, where so many different types of men are engaged, there is no substitute for working in the same organization. No talk of "collaboration" can obscure this fact. I can give a striking illustration of the value of this type of organization, in dollars and cents, and its comparison with a contractor's organization. The story would be still better if I could give the names. A client had plans prepared for a group of buildings estimated to cost well over a million dollars to construct. A building company of national reputation was estimating the project on a cost-plus-fee basis. The architect, who had himself undertaken construction work on a large scale, was coöperating with builder and client in the familiar process of "getting the costs down." The architect called me in on the estimates. "See here," he explained, "they have allowed some $53,000 for office overhead. What do you think of that?" This allowance was in addition to the cost of the actual erection, but not including field office. We made a rapid calculation and figured that $15,000 was an outside figure to allow for the work, as based on a similar operation the architect himself was undertaking. This episode is significant in several respects. In the first place, the excess allowance for overhead in the general contractor's estimate would have paid the architect's cost of doing this work, and a fat fee besides. Secondly, when I related this story in a recent conference with two executives of another large contracting firm, they said that the contractor's estimate was "about right," and that their own cost would have been the same. Third, the architect could have erected that building at a lower cost per cubic foot than the general contractor, as well as making a saving to the client on overhead and fee. The client knew this to be true, but nevertheless he employed the general contractor. The reason was that the contractor put capital into the project to the extent of becoming the principal owner. The client's chief interest was in selling the land. The buildings did not sell or rent very well.

and expectation of profit was apparently not fully realized. This story presents a very complete picture of the role of architect in construction work.

It is easy to understand that it is an important asset for an architect to undertake construction successfully. It strengthens his organization in a remarkable way, perfects it to an extraordinary degree because of the constant direct contact with builders, and, of course, enables it to give,—or at least to appear to give,—to the client just the service he ought to get. To the public it makes architectural services seem real, as they often do not in conventional practice. This makes for better fees.

It should be apparent that success in construction work depends not only on the architect's forming a strong, permanent organization, but also on supplying that organization with a sufficiently steady volume of work. Otherwise, his organization fails of its purpose, which is to offer a more experienced, more closely knit and more accurate service in competition than that of the general contractor. This purpose is defeated if the organization is not kept busy and is reduced or disbanded, to be again recruited when commissions come in. Such an organization is difficult to obtain and difficult to perfect. It cannot be improvised by constant hiring and firing, as is frequently supposed. For one thing, the construction men should be of a finer, more aggressive type than is the average "practical" or "construction" man in the usual type of office, who is too often a hack, a typical inspector, more plodding than energetic.

There is an additional reason for ensuring steady volume of work. In addition to his formal organization, the architect, to succeed, must acquire a "following" in the local construction world. The subcontractors, supply houses, material men, truckmen, labor leaders, mortgage interests,—all must learn to realize that the architect's organization is a strong factor in the construction field, whose good will is worth cultivating. Without this following the architect will suffer in many ways. In times of a shortage of labor or materials, for instance, the architect's organization will not obtain the needed service. Also, his sources of information will dry up, and he will lose control of costs. Such an organization quickly goes down hill without the architect's realizing what is happening. Like the man whose wife is unfaithful, the architect may be the last to learn about what has happened in his own household.

As suggested in the beginning of this article, the architect's own talent is an important factor. Architecture is an art, a profession and a business. It is rare when an architect omits successfully even two of these spheres in his work, to say nothing of all three. Even in the field of business,—which is always expanding in architecture under the pressure of modern technical and industrial complexity,—even here the architect may be a better salesman than executive. Or in construction he may be a better executive than constructor. Hence the architect's personal relation toward contracting construction may vary. Perhaps sound, well rounded organization is the best general answer to such individual matters. The chief of the construction department should have a major relationship to the architect, if not in the form of a partnership, at least in almost as important a role, one that includes possibly the ability to promote new business or to assist in obtaining new business, as well as to engage in actual erection. The chief in charge of construction should be a most capable, forceful man, of true partnership material. The architect cannot afford to have less, neither can the construction head afford to *be* less.

In conclusion, it seems probable that the question of whether the architectural profession as a body will undertake construction must be decided by the pressure of circumstances, mostly economic, rather than by any theory. On this question, a sound body of opinion holds that the architect has a definite professional role, essential to the proper functioning of the building industry, and that he will do best to keep to that role, whatever be the good results obtained by occasional individuals' competing with contractors. As proof of their contention, they cite the statistics showing that architects control a vast majority of building projects of any size. They also point to the historical evolution of the modern American architect out of the contractor, and they look upon any return to earlier conditions as a step backwards. This conservative view is sound, and it puts the burden of proof on the pioneers. They have on their side the truth that there is much duplication between the architect and general contractor today, and that the client objects to paying two people to do the same thing. At present, in the division of fees, the architect is likely to get the short end, as illustrated by the fact that, although the architect is today in charge of construction work, he barely gets a living wage in return for his huge technical and business responsibility. Unless he speculates he has almost no chance for those "killings" sometimes possible in business. Furthermore, the business complexity is growing. It seems to have arrested, if not actually pushed down, that splendid artistic achievement in architectural standards, which is the very life blood of the profession. The promoter-architect or real estate architect is coming more noticeably to the fore in recent years. Is he any more of an architect than is the builder-architect? Again events must decide. One may suggest that if American large-scale methods ever do spread into the building world, we shall see startling changes in the practice of architecture. Among them may be a drastic elimination of competing organizations. There may also occur, in the attendant financial reorganization, a condition of less real estate and more technology in architecture. The designer may be more closely allied with the carrying out of his designs than is now generally the case.

THE RELIGHTING OF THE FIRST CHURCH OF CHRIST, SCIENTIST, BOSTON

BY

R. B. BROWN, JR., and KARL ANTON PIEZ

FOR the last ten years the officials of the First Church of Christ, Scientist in Boston had been considering proposals for relighting the "Mother Church" in a more adequate manner. A knotty problem was presented, involving modification of existing equipment, installation of new luminaires according to good lighting principles and in harmony with the architectural design, and in addition a novel application of various systems used in modern illuminating engineering practice. The solution of this special problem, through the coöperation of the church authorities, the engineers, the manufacturers of the equipment, and the electrical contractor, has many fascinating and instructive aspects.

The "Mother Church" is a conventicle type of building, in which attention is generally directed to the reader's platform in front of the congregation. However, interest may be focused upon any part of the auditorium, as various members arise to address the congregation, and adequate illumination, though brightest on the platform, is needed everywhere else in the huge auditorium. The church is of Italian Renaissance design, with the great central dome flanked by two smaller semi-domes. The building itself has a frontage of 236 feet, is 144 feet deep, and the extreme height is 224 feet,—3 feet higher than the Bunker Hill Monument. The first story is of New Hampshire granite and Tennessee marble, above which limestone has been used. The dome, semi-domes, and cupola are of cool gray, semi-glazed terra cotta. Limestone and marble are used as the interior materials, with very elaborate plaster ornamentation. Carved and colored marble also forms part of the wall decoration. The woodwork is mahogany. The auditorium has splendid proportions, and seats five thousand persons.

The original system of lighting was installed in 1906. At that time the main auditorium was lighted by eight massive bronze chandeliers, each having 73 exposed lamps. In the semi-domes, bare lamps on 8-inch centers were concealed above the cornices, and the ceiling pieces under the balconies and elsewhere contained clusters of three or more bare lamps. On the walls about the auditorium were torcheres equipped with many lamps, usually in pyramidal forms.

Since this initial installation was made, every advance in illuminating engineering naturally emphasized the need of an improved lighting system. The fixtures containing the exposed lamps were obviously out of place, and the lamps themselves, being replaced through the years by more and more efficient units, became sources of harsh glare. Proposals for a design of a new lighting system for the main auditorium had long been considered, and many specialists had been consulted on the problem. The proposals were various, such as to secure:

1. An improved design of the eight existing chandeliers.
2. Indirect lighting from eight fixtures.
3. Indirect lighting from coves.
4. Indirect lighting from one fixture.
5. Floodlighting through windows.
6. Floodlighting through new false skylights.

In each of these plans the semi-domes were to be cove-lighted as formerly, and all supplementary luminaries were to be retained around the auditorium, after having been so changed as to provide comfortable light. The real problem was to light the central area of 8,800 square feet with a dome ceiling 108 feet high, 90 feet in diameter, and starting 75 feet from the floor.

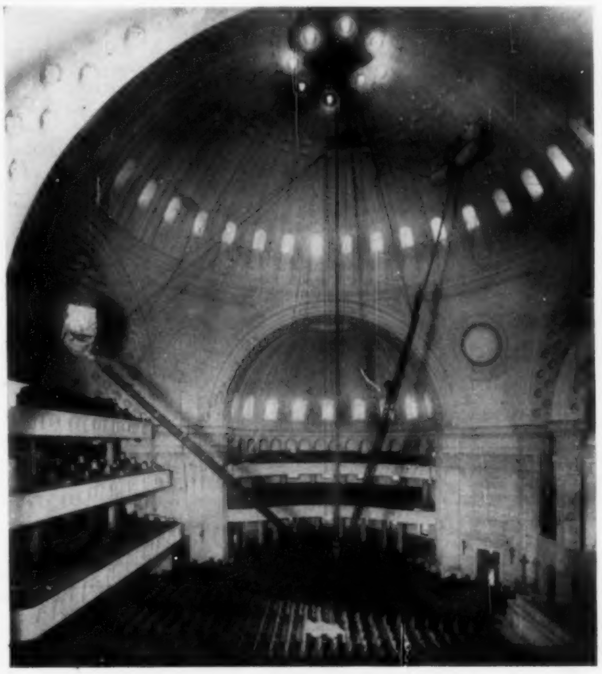
It was decided that a scheme of floodlighting was the ultimate solution, preferably a scheme which would give a desirable cove lighting effect. The plan adopted consists of floodlighting the central dome itself through the oculus. The light is directed from just below the skylight glass down upon the walls of the plaster dome, and from there indirectly to the floor of the auditorium. The advantages of this scheme are that:

No changes were necessary in the architecture.

A most desirable effect is attained.

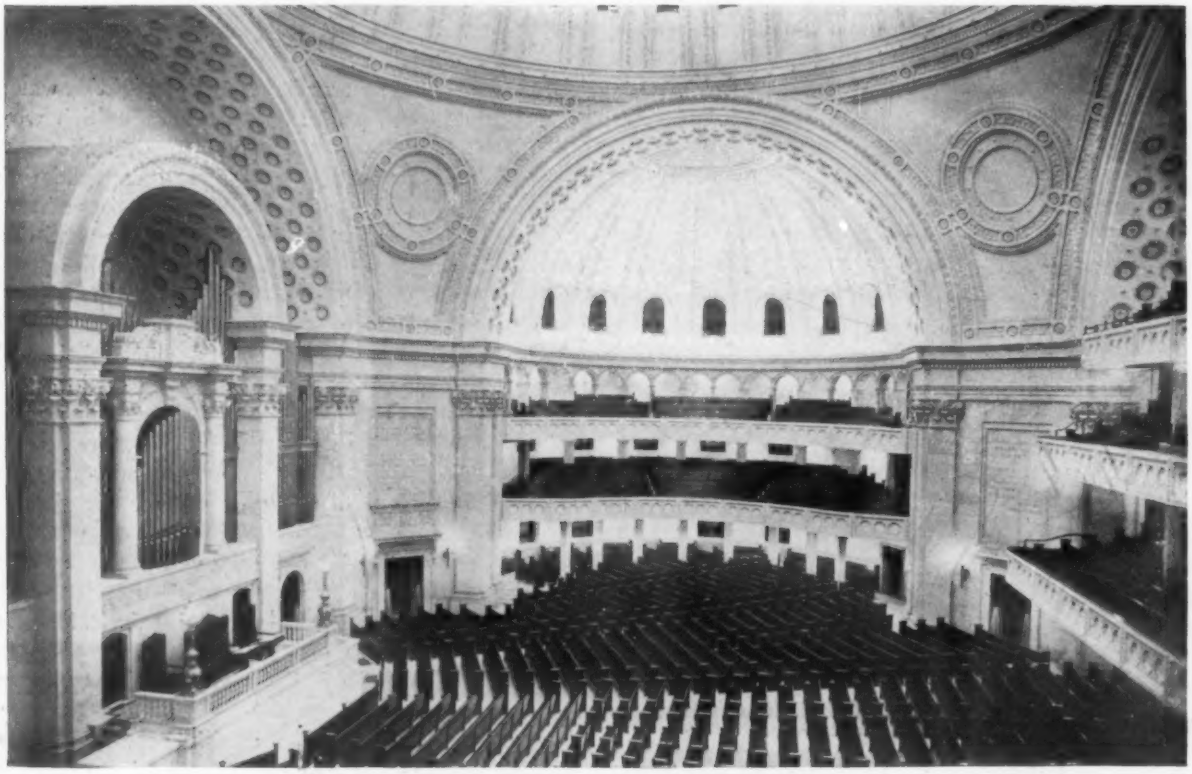
The lighting equipment is entirely concealed, yet readily accessible.

Standard floodlighting equipment is used, and both the initial and operating costs were reasonable.

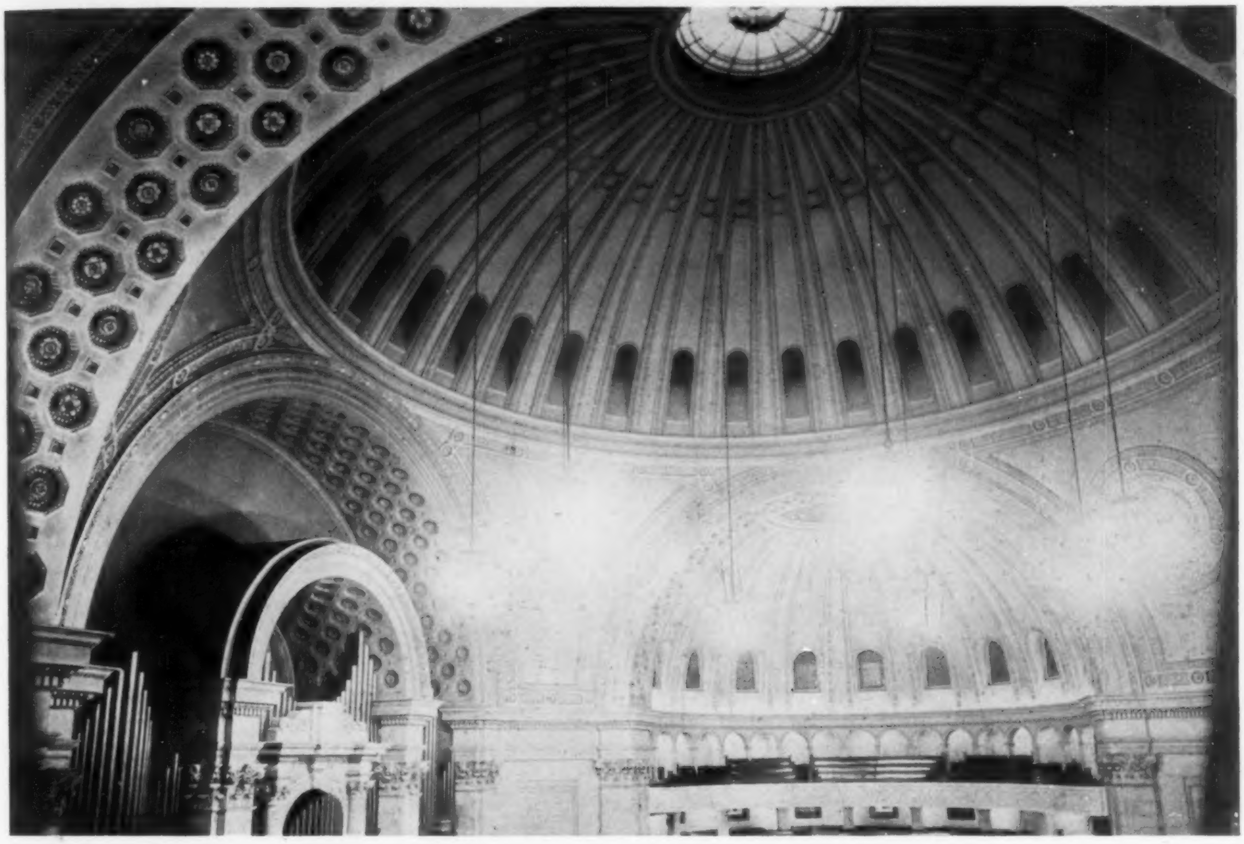


Booms Used in Refinishing Interior

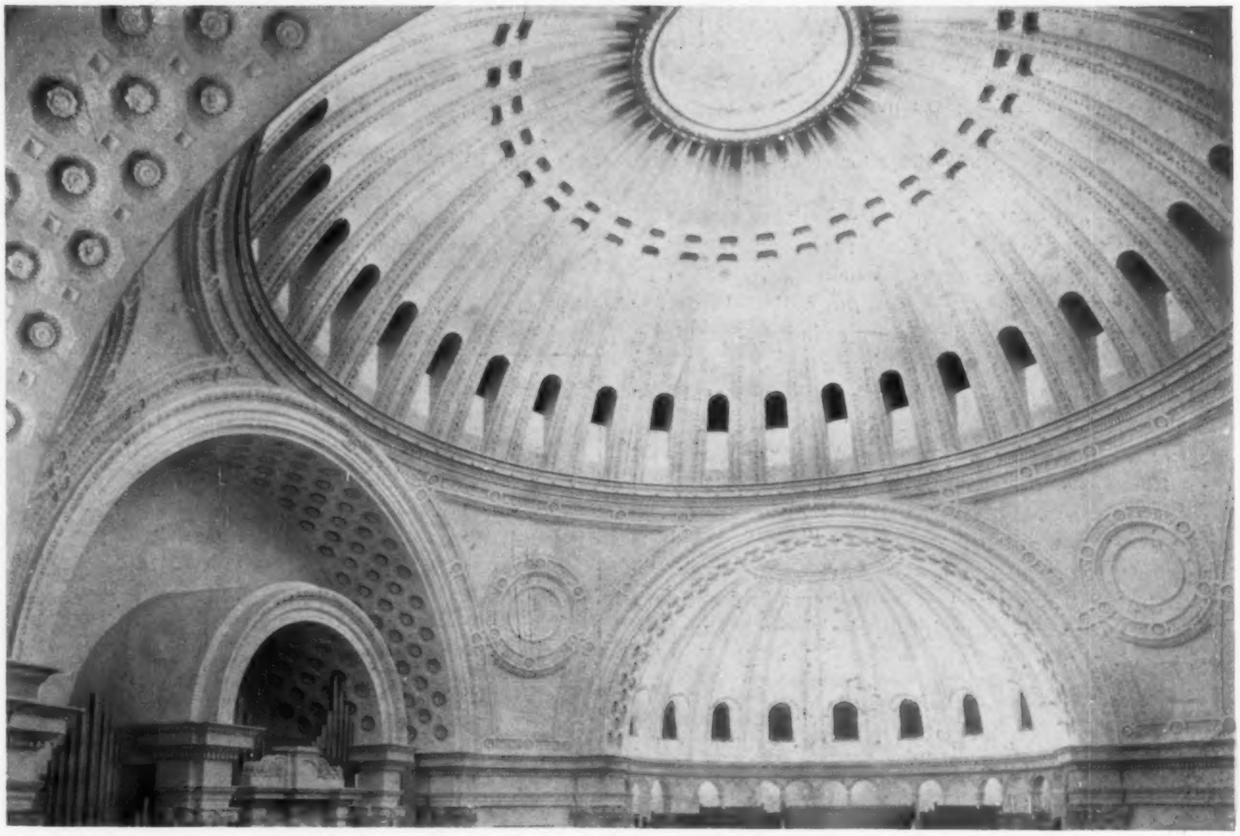
MAIN AUDITORIUM BEFORE RELIGHTING



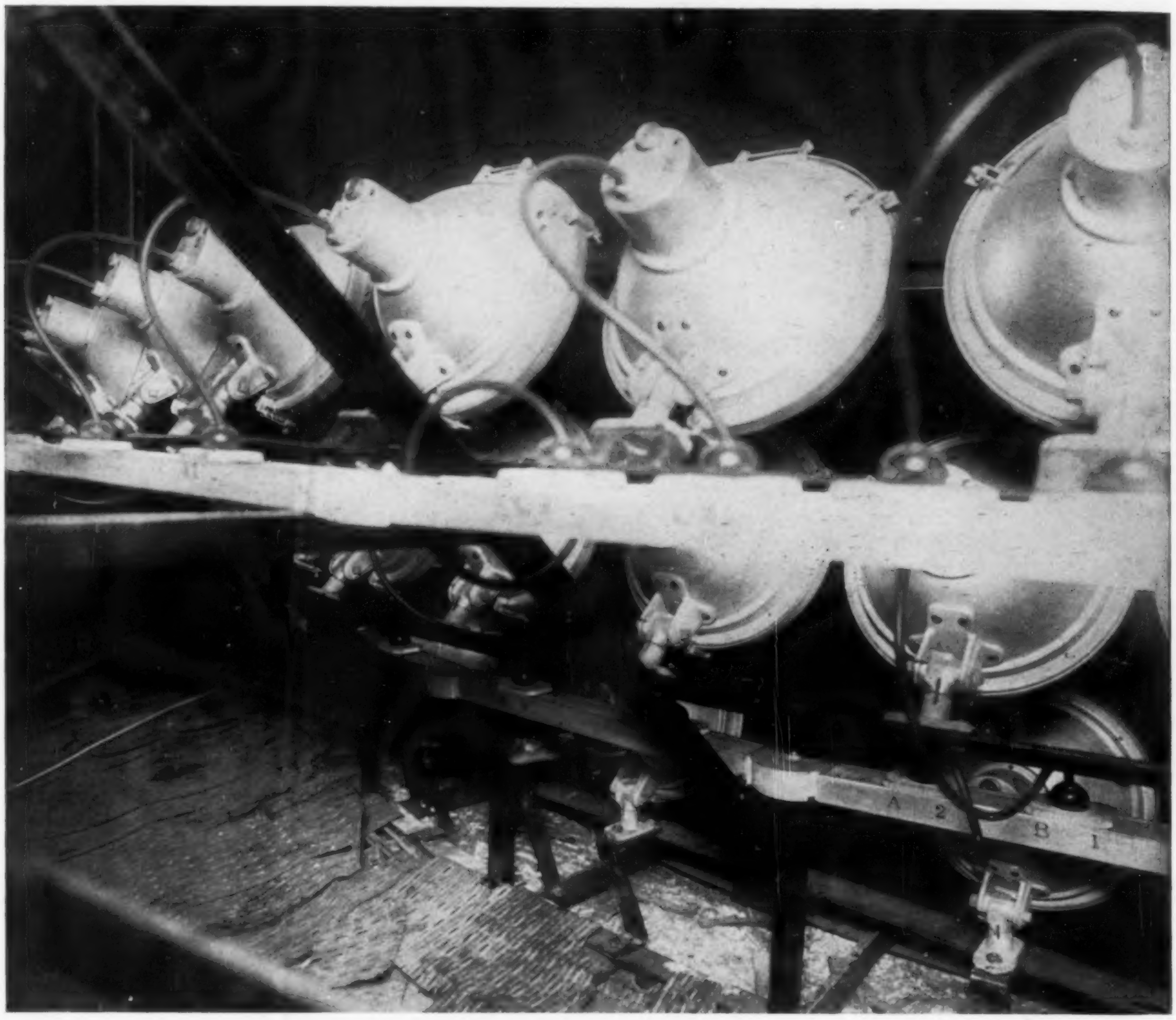
EFFECT PRODUCED BY NEW LIGHTING ARRANGEMENT



VIEW OF CENTRAL DOME BEFORE RELIGHTING



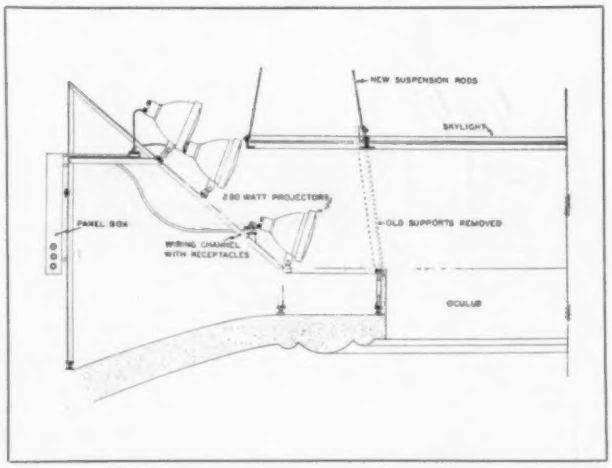
CENTRAL DOME RELIGHTED



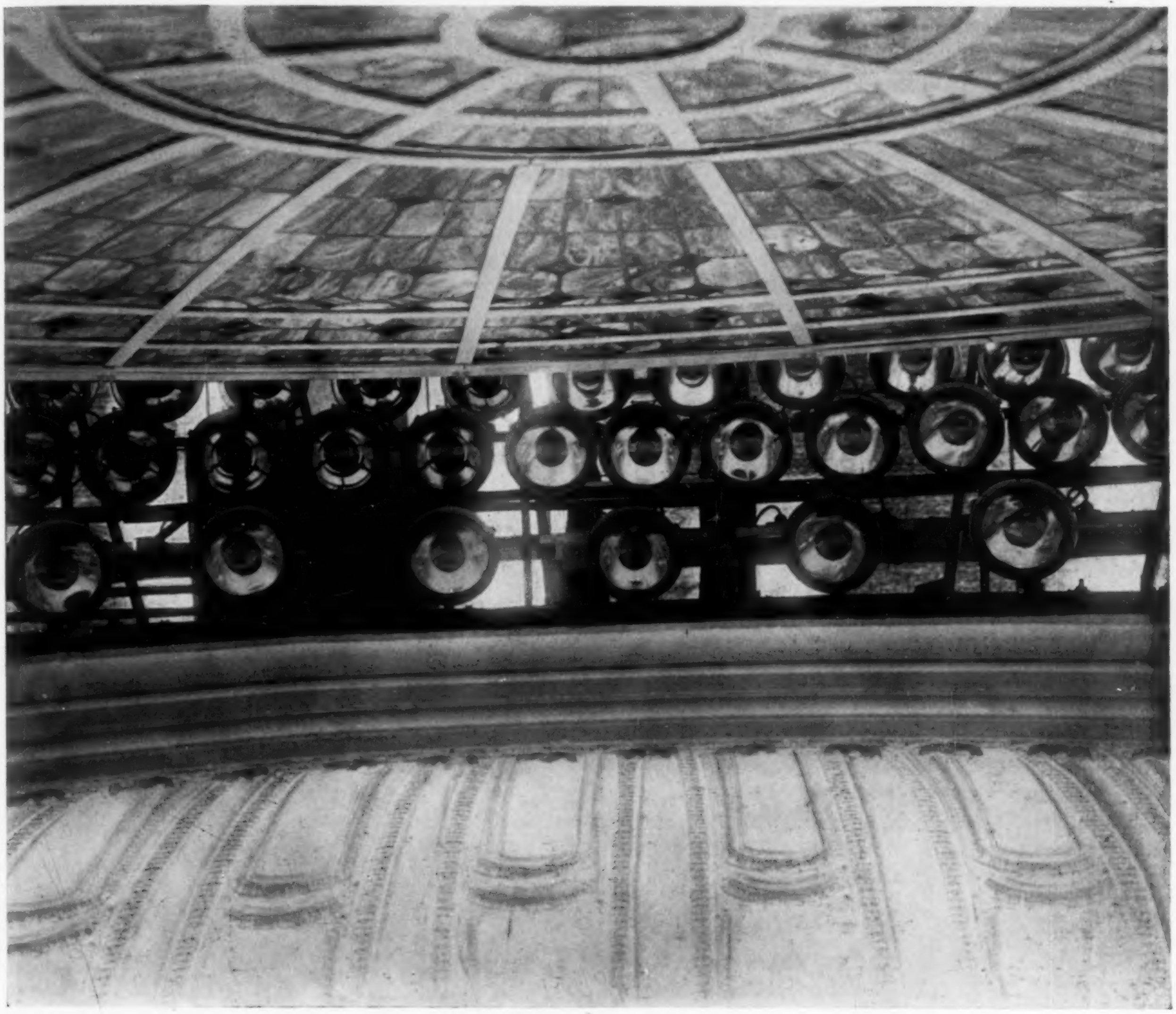
Projectors Mounted Above the Oculus for Lighting the Dome

In deciding upon the actual layout in terms of wattage, the reflecting factor of the plaster dome under reasonably clean conditions was found to be 48 per cent. Considering the area to be 10,000 square feet, and thus giving an adequate factor of safety, the designers arrived at the figure of 4 watts per square foot or a total of 40 kilowatts necessary in order to provide the auditorium with sufficient illumination. To insure evenness in the spread of light over the entire dome, it was decided to use small units, and 250-watt projectors, having a beam spread of 12 degrees with lamp at focus, were selected. The comparatively large number of small units gave the advantage of directing the light from at least five projectors on any one point in the dome. The projectors were mounted on a special steel circular framework in three tiers. The skylight glass above the oculus itself was widened 30 inches to hide the projectors from the line of sight. It was found desirable to transmit direct light downward through the glass for the sake of appearance. Twelve 500-watt floodlights give enough brightness to the glass.

For the two semi-domes, a new and efficient cove-lighting installation was made, using 50- and 100-watt inside frosted lamps alternated, located in groups. The throw of the 50-watt and 100-watt in-

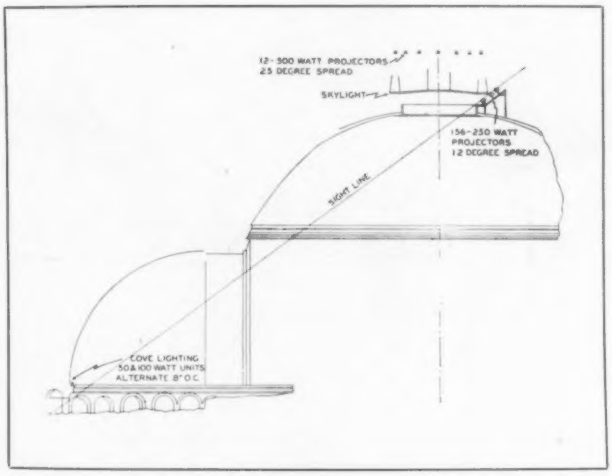


Method of Mounting Projectors



Projectors Installed for Lighting Through the Oculus of the Dome

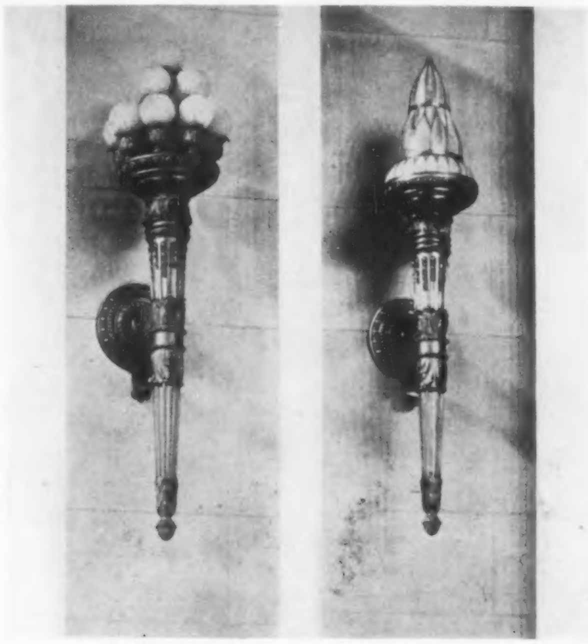
side frosted lamps was alternated in the groups. The throw of the 50-watt lamps is straight up, and that of the 100-watt lamps is tilted slightly forward. Silvered glass reflectors were used on the old outlets. On the pedestals lighting the reader's platform and on the torchere brackets around the walls of the auditorium, new tops were installed in order to overcome glare. In addition, various other types of luminaires were designed and made for the spaces under the balcony, in the colonnades at the rear of the side balconies, on the rear auditorium wall, and on various stair walls. Totally indirect lighting from suspended fixtures was also adopted for the Sunday School room.



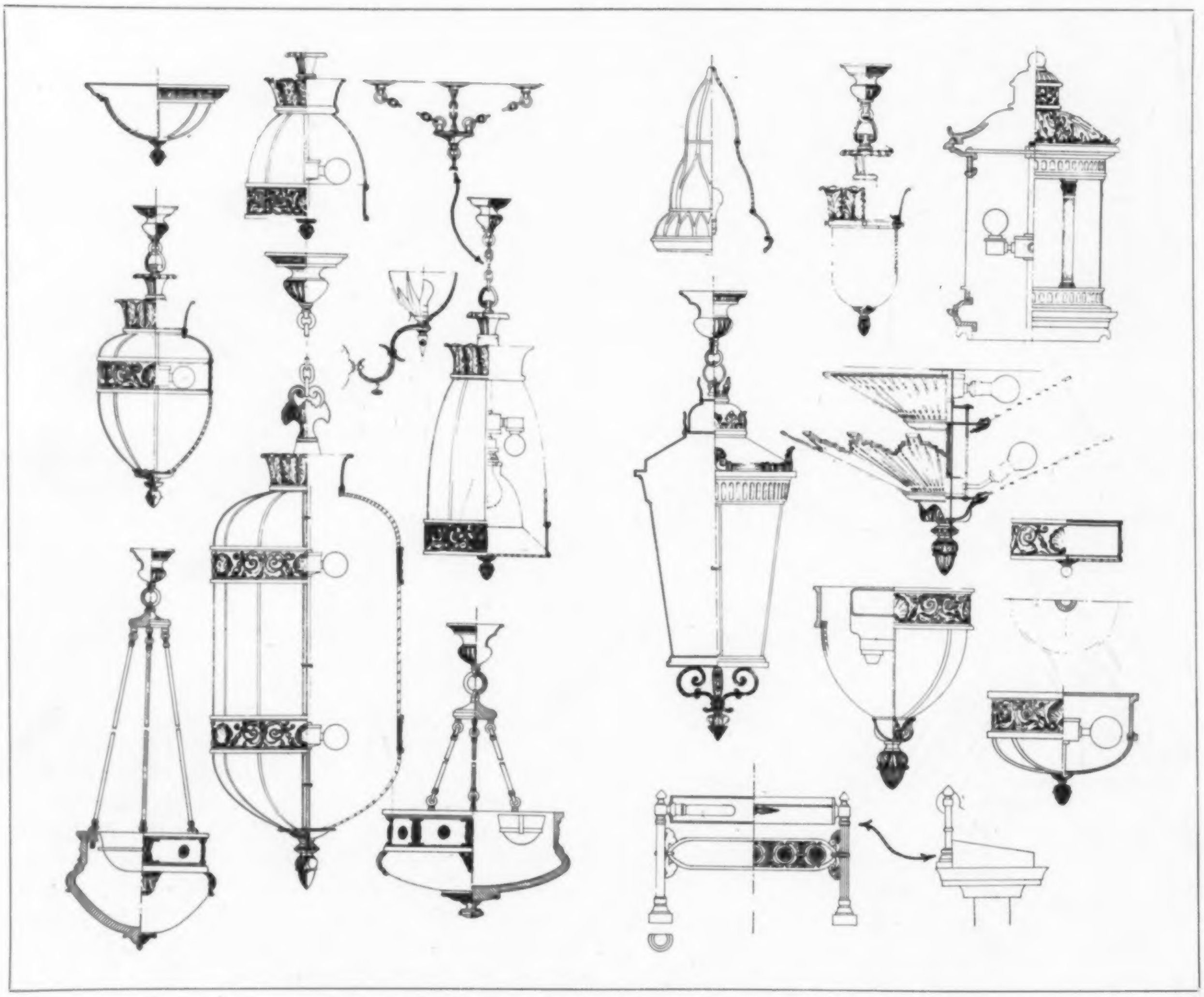
Lighting Scheme, Main Auditorium

The result of the main auditorium lighting is an even illumination on the main floor of the church at a level of 7-foot candles, which is unusually high for church lighting at present. This may be cut down one-quarter or one-half, since the projectors are on three circuits. The cove lighting in the dome and the semi-domes may be switched one-third, two-thirds, and full intensity. The flexible lighting scheme which has been adopted is entirely in keeping with the type of service in the church. All the luminaires are of appropriate design, and the indirect lighting effects reveal the full beauty of the entire interior.

PLATFORM LAMPS, OLD AND NEW



TORCH BRACKETS, OLD AND NEW



DETAILS OF THE VARIOUS NEW LIGHTING FIXTURES

FIRST CHURCH OF CHRIST, SCIENTIST, BOSTON

√ THE CLIENT, THE ARCHITECT AND THE CONTRACTOR

PART I. THE CLIENT

BY
CLINTON H. BLAKE

FOR many years I have been called upon to advise alike the owner, the architect and the contractor. As a result, I have had rather unusual opportunities for becoming familiar with their attitudes, the one to the other, and with their conceptions of their respective rights, liabilities and duties. A very large percentage of the misunderstandings and difficulties which arise between them is due, not to any conscious desire on the part of anyone to be unfair, but rather to certain fundamental misconceptions of the obligations which each of them owes to the others. If these misconceptions can be removed, and if there can be brought home to these three chief participants in the building operation a true understanding of their respective rights and liabilities, the benefit to each of them will be considerable. My purpose here is to point out, so far as I may, some of the major points of misunderstanding and misconception.

Year by year the architect and owner, broadly speaking, are approaching, I believe, a more thorough understanding and accord. Year by year, also, there has been a corresponding betterment in the understanding of the contractor and in the relations existing between him and the architect and owner. While there are many points of irritation and misunderstanding, in a very large percentage of cases the difference will be found, on analysis, to have resulted from one of a comparatively few causes. In the main, the difficulty heretofore has been that the architect has to a certain extent isolated himself in his professional atmosphere, that the owner has made too little effort on the other hand to understand the professional attitude and point of view of the architect, and that the contractor has failed to realize, as generally as he should, the potentialities for good to him in a closer and more whole-hearted coöperation between his organization, the architect, and the owner. It is not my purpose here to engage in a technical legal discussion, but rather to point out in general the points of misconception and the causes of differences between these several parties. A fuller understanding on their parts of their legal obligations and rights is naturally desirable. They should be able to attain this, however, without the confusing admixture of legal red tape and discussion. Where necessary, in the future as in the past, they can secure legal advice and unload their worries upon their attorneys. The really important thing is that they should so clarify their understandings of the respective positions which they hold in the building operation and of their rights and liabilities in general, that controversies between them will *not* develop to a point were legal action will be involved.

1. The Point of View of the Owner. The ordinary client's conception of the ordinary architect is at once flattering and disparaging. On the one hand, he attributes to the architect abilities in discounting the future and in securing perfect results far beyond the point of reason. On the other hand, in many cases he believes the architect to be an eccentric, artistic soul, possessed of temperament and ability, but wholly lacking in business understanding and often even in common sense. This latter conception is giving way rapidly, as a result of the increased understanding among architects of the business and practical elements involved in the practice of their profession. It has been and is responsible, however, in repeated cases, for the failure of an owner to employ an architect, where he might otherwise do so, and for many of the instances where owners undertake to plan and erect their own houses, with the aid of a builder and without securing any trained architectural advice. Such a proceeding is not in the interests of either the owner, the architect or the contractor. The architect is a vital factor in any properly conceived and carried out building operation. His participation in such an operation benefits the owner and the contractor alike. Not only does it result obviously in the securing of a better and more valuable result, but it contributes to the situation, in the person of the architect, the balance wheel which goes far to remove needless causes of irritation between the owner and the builder and to insure to each of them fair treatment.

The client's conception of the architect as an artistic soul, largely lacking in practical understanding and common sense, is, of course, wholly unjustified. I have had occasion elsewhere to express and to reiterate my firm opinion that artistic and business ability are not incompatible. In repeated instances we find architects possessed of the highest artistic training and ability who are, at the same time, possessed of sound business sense and judgment. The architect of today must face business practicalities and conditions to a far greater extent than ever before. The complexities of modern life and of modern business structures, the adoption of building laws and zoning ordinances, the complications involved in labor conditions and in the material market, all make it essential than any successful architectural organization include business as well as artistic and technical capabilities. As architects have more and more become aware of this fact and recognized the need of business training and ability in their profession, so they have correspondingly broken down to a large extent the old misconception of the owner and brought to him a realization of the fact that the modern architect may be quite capable of exercising business practicality and understanding in his handling of the client's problems.

The flattering misconception of the architect by the owner is, curiously enough, more destructive of ac-

cord between them than the uncomplimentary conception which we have just discussed. The client in many cases holds, firmly fixed, the idea and opinion that the architect, as a result of his technical training, is necessarily omnipotent in many ways. He believes that the architect can tell him the exact cost of a proposed building; that he can foresee to a nicety the cost of labor and material; that he can foretell exactly how the completed whole will appear; and, above all, that he can and will so oversee the work as to provide a 100 per cent complete and satisfactory structure. Such a conception, while flattering to the architect, is full of dynamite. He will be far better off, in proportion as he can bring the client to understand that he cannot foretell accurately the costs of labor and materials; that he cannot guarantee a perfect building, either artistically or mechanically; and that he can but do his best, with the special training which he has had and with due diligence, to approximate the ideal which the owner has in mind.

The average owner, in his attitude toward the building operation, falls into one of two errors,—either he feels that he is competent and called upon to tell the architect how things should be done, or else he throws all responsibility upon the shoulders of the architect and expects the latter to accomplish a splendid result, without real coöperation from him. If the owner must follow one of these courses, instead of the common sense middle road, it is preferable, certainly, that he should leave matters in the hands of the architect, rather than endeavor unduly to dictate the action to be taken. I know of nothing more irritating or demoralizing to the friendly relations of the parties and the good of the project than a client who is forever fussing over details, changing his mind, issuing new instructions, and acting generally as if he were himself quite competent to act as architect or contractor, or both. In handling a client of this kind, the architect is called upon to use tact and discretion, and above all to have a sense of humor. He must use tact in order that he may not unduly irritate the client. If the client be given his head to some extent and allowed to talk, he will usually in the end meet the recommendations of the architect, if the latter does not endeavor to force them upon him too strenuously in the first instance. The use of discretion by the architect in this connection is, however, necessary. He cannot safely ignore the client's requests for changes. He must be careful to keep the record quite clear and be in a position at any time to show that where the work has been continued in accordance with his recommendations and after contrary suggestions by the client, this has been done only after the latter has acquiesced and finally approved.

The client has commonly a misconception, also, of the professional status and obligations of the architect. Very nearly without exception, the client will hold the point of view that the architect's sole obligation is to him; that the architect is employed by him and must act solely as his representative and adviser, and that he owes no obligations to anyone else in connection with the building operation. It is perhaps a natural thing that the layman should have this misconception of the architect's duties and responsibilities. It results probably from the fact that he regards the architect exactly as he would a lawyer or a physician,—as one whose sole obligation, aside from engaging in ethical and honest practice, is to his client. The fact is, of course, that the architect, while his primary obligation is to the client, has nevertheless a very real and important obligation to the contractor. The client loses sight entirely, ordinarily, of the quasi judicial functions which the architect, in his supervising capacity especially, is called upon to perform. He fails to realize, until he is educated so to do, that the architect is called upon time and again to make, in effect, a judicial and fair determination in questions involving interpretations of the plans and specifications, the character of the work done, the issuing of certificates and the like. The architect should not and cannot safely or properly be the advocate of the client alone. Where the contractor is in the right, the honest architect will support him.

When all is said and done, 90 per cent of the misunderstandings between owner and architect have to do with changes in plans, with supervision, or with questions of cost. In part, these misunderstandings result from a misconception on the part of the architect with respect to his proper rights and functions in these matters, and in part from a misconception with respect thereto on the part of the client. I shall have occasion to discuss in a succeeding paper the ways in which the architect errs in this connection. For the present, we are interested in the attitude of the client. With respect to changes, the layman has very generally the idea that his architect, without any increase in his fee, is supposed to make any and all changes in the studies and drawings which the client may from time to time desire; that it is part of his professional duty to make, within reason, any number of preliminary studies and to continue turning out studies and drawings and specifications, until he has produced those which meet fully the requirements of the client.

Given a client who knows his own mind with reasonable definiteness and who is himself reasonable, the architect will not have so much difficulty on this point. Given the ordinary client, however, who starts out with a more or less indefinite idea and insists thereafter, alone or in collaboration with his wife, on successive modifications of it, and the architect is presented with a real problem. He must satisfy the client or break with him. At the same time he must, in justice to himself, either receive additional compensation for his extra services in making the changes or so limit the changes made that they will not seriously reduce his profit. The owner is gradually being educated to an understanding of this situation by the employment of contracts between owner and architect and by the slow but

general improvement in a better understanding by the layman of the architect's status and methods. The layman ordinarily has no conception of what it costs the architect to produce studies and working drawings, not to mention details. He may be somewhat impressed by detailed drawings, but he is ignorant, as a rule, of the sums which must be expended to produce the finished drawings which are placed before him for his approval. To him they are merely mechanical drawings, which might be produced readily in a few hours' time. He has little conception of the amount of time which has gone into their production, of the costs of draftsmen and office overhead, and of the amount of time which the architect or his assistants in design and construction have given to the study of the particular problem in hand. It is natural that the client should have this point of view. Every professional man labors under the same handicap. Where a lawyer draws a contract, the client, unless he has been compelled to attend conferences during the time that it has been in preparation, sees only the finished work and does not realize the hours of research and the time given to preliminary drafts and changes which are responsible for the final document. The client of the architect has the same point of view. This again is a matter of education. Gradually the client will secure a better understanding of what it costs to produce his work and to maintain and operate a modern architectural office and organization.

The second chief point of misconception by the client relates to supervision. It is not at all an extreme statement to say that the client ordinarily holds the point of view that the architect, by reason of his training, should be and is able so to supervise the work as to insure substantially a perfect result. He has the point of view that the architect's fee covers whatever service is necessary in this connection. He has little, if any, conception of the wide difference between ordinary architectural supervision and the supervision of a resident superintendent or clerk of the works. Here again the misconception of the client is gradually being removed. The Institute's form of contract and other contracts in use have specifically directed attention to the difference between ordinary and constant supervision. In time, the client will gradually come to recognize and appreciate this difference. At the present time, however, in a very large majority of instances, the client is still of the impression when he goes to the architect, and unless he has had prior experience in building matters, that it is the duty of the architect personally or through his organization, and without extra charge, to supervise the driving of each nail and the placing of each shingle.

One of the most common and dangerous misconceptions held by the owner relates to the cost of construction. Here again the owner is wont to endow the architect with powers of divination which he does not and cannot in reason possess. On the one hand, the owner expects that the architect can design a building to fall within any cost upset figure which he may give. On the other hand, he believes that the architect can give an accurate estimate of what the building will cost when erected in accordance with the plans and specifications presented to the owner for his approval. The client is wrong on both of these points. It is possible, of course, for an architect to be so conservative in the plans as to insure a building of a cost less than a given amount. Unless, however, he allows a very liberal margin for this purpose, he cannot be sure that the structure will not exceed the limit named. The best that he can do in the ordinary case is to design the building in accordance with his best judgment and, if the bids received exceed the limit, suggest changes and cuts which will reduce the cost to a figure below the specific amount. The owner cannot ordinarily understand why the architect cannot approximate the cost more closely in the first instance. One of the chief difficulties lies, also, in the fact that, after the more ambitious plan has been presented to him, the owner is loath to agree to the prunings and changes in the plans which are necessary to meet his financial requirements. This is only human nature, but it does not help the architect or work for a better understanding between owner and architect.

With regard to the giving by the architect of cost estimates, the owner is under a particular misapprehension. He believes, ordinarily, that the architect should, by reason of his experience in his profession and his technical training, be able to estimate with reasonable exactness the cost of the work called for by the plans and specifications. While he realizes probably, as a business man, the uncertainties of the labor and material markets, he nevertheless believes that the architect is so trained as to be able accurately to gauge these conditions and to give a substantially accurate estimate of cost. When it develops that an estimate given by the architect is over-conservative and that the cost is less than he has estimated, no harm is done. When, on the other hand, as is much more likely, the owner receives a bid far in excess of the estimated figure, his reaction in too many cases is that the architect does not know his business and that he has been misled into going ahead with sketches and plans for work which is beyond his financial resources. Under these conditions, he will either call off the project and object to paying the architect for the work already done, or he will proceed with the work and have changes made in the plans and specifications, but feel that he is not under any obligation to pay for the time involved in making these changes.

Another cause of irritation and difficulty for which the owner is often responsible results from his undertaking to give directions with regard to the work direct to the contractor or workmen and without the knowledge of the architect. Ordinarily, there is no intention on the part of the client to go over the head of the architect in taking action of this kind. In giving instructions to the contractor he has

little realization of the difficulties which may arise as a result. The contractor also is to some extent at fault, if he accepts instructions from the client without the approval or confirmation of the architect. On the other hand, it is quite natural if the owner, who is the principal in the transaction and the person with whom his contract is made, comes to the contractor and gives him a definite order, that the contractor should execute it. The client, by giving orders direct rather than functioning through the architect, seriously impairs the latter's authority.

This is not the most serious side of the matter, however. The more important thing is that the client, in ordering changes, has no conception of what they will entail. A change which to him as a layman appears comparatively simple, may result in other serious structural changes. These, in turn, result in "extras." Before the matter is concluded, the client in all probability will be blaming the architect for the very extras which resulted from the orders given by the client himself. Having employed the architect as his professional adviser, the client should support him in that position and, in his own interests as well as in fairness to the architect, submit to the architect and not to the contractor any suggestions or requirements which he may have. The architect will then be in a position to advise the client whether they are in his opinion reasonable and practical and what their general effect, both as to design and as to cost, will probably be. Often the client will realize that his suggestions are impractical and will drop them. Where they are approved by the architect, the latter will supervise their execution far more intelligently and effectively than the client could do.

The client, the owner and the contractor have each a well defined part to play. Each of them should keep within the limits of his own sphere of activities. The more completely this can be brought about, the less friction there will be and the better will be the results secured. The ordinary client is fair minded and reasonable. He desires nothing which is not right, and does not consciously intend to demand of his architect anything which is unfair. If he can, by slow but sure education, be brought to understand more fully the duties and limitations and problems of the architect, he will gradually revise his conception of the duties which the architect owes to him and of their respective rights and liabilities. The education of the client in this respect rests largely in the hands of the architectural profession. There can be no question that time given to forwarding such education in public and written discussions and in such other ways as may be possible, will remove many of the more dangerous points of irritation between architect and client and result in substantial benefit to each of them in the form of a better understanding and enhanced mutual good will and coöperation. I can conceive of no more worth while service which a publication such as THE ARCHITECTURAL FORUM, read by architects, contractors and laymen alike, can perform than to take an active and constructive part in promoting a better understanding by these three parties to the building project of their respective rights and liabilities. Such an understanding cannot fail to result in a general betterment of building trade conditions, in an increase in the effectiveness and authority of the architect, and in benefit to all concerned.

As a matter of fact, the owner is quite justified in feeling that the architect should be qualified and prepared to protect him with respect to many details of business administration in connection with the work. In the nature of things, the owner cannot be expected ordinarily to know what the building laws and local ordinances require. He cannot be expected to know the zoning and similar requirements as the architect is presumed to know them. He is not expected to be acquainted with fireproofing and other similar ordinances. The owner can rightly demand more of the architect than that the latter translate into plans the owner's desires. He can and should demand that the architect know whether those desires can legally be carried out, and that if there be any conflict between them and the requirements of the state or municipality in which the work is done, the architect should so advise him.

This does not mean that the owner can expect the architect to be his lawyer. It does not mean that the architect is obliged to advise the owner in matters relative to the building contract and he like which are properly matters for the owner's attorney. It is difficult to lay down exactly the dividing line. In general, however, it may be said that the owner is justified in expecting intelligent advice from his architect on those business or legal requirements which relate to the legal filing and approval of the plans. If the architect undertakes to prepare plans for a client, he is expected to so draft them that they *are* legal and such as the proper authorities will approve.

On the other hand, the owner cannot expect the architect to act as his guardian on all points connected with the work. On matters not clearly related to the architect's services, the owner must protect himself. The architect must use reasonable skill and diligence. He is not expected to be omniscient. He should be prepared and equipped to advise upon and attend to the business and legal requirements connected with his professional services. Beyond that the owner is his own keeper.

SANITARY DESIGN IN MODERN BUILDINGS

HOT WATER SYSTEMS

BY

HAROLD L. ALT

THE furnishing of an adequate supply of hot water for a building is one of the most uncertain problems involved in plumbing design. Types of buildings vary in purpose, and each building of each type varies from others in its requirements. The hot water system for a school will not be the same as that for an apartment house, nor will an office building have the same system as a church. Industrial buildings constitute a problem all by themselves; institutions, laundries, kitchens and bath houses must be considered individually, and the best possible judgment must be used in each case. No two authorities agree on the quantity of hot water which will be used in the various types of buildings, because there is so much variation between the amounts used.

Various rules have been evolved for computing the probable hot water demand for a structure, but there is nothing to guarantee that the occupants of a building are going to be governed in the slightest by the arbitrary assumptions made,—and which must be made,—in the original calculations. One method which seems to have at least a basis of common sense is to calculate the hot water required for the maximum use of each kind of fixture, and then to multiply this by a percentage of "probable" use for normal conditions and to allow *double* this for "peak" conditions. It will be noted that this method resembles that used for determining the sizing of cold water pipes. To apply this rule it is assumed that the maximum possible use of hot water in a lavatory is about a half-gallon of hot water for each user, and that an average washing in the lavatory would require about a minute and a half. Then the maximum number of gallons it would be possible to use in a lavatory per hour would be:

$$60 \div 1\tfrac{1}{2} \times \tfrac{1}{2} \text{ gal.} = 20 \text{ gal. per hour.}$$

A sink is taken at about 30 gallons per hour, and a slop sink at 20 gallons per hour; a bath is assumed as requiring 20 gallons for each user and that two baths per hour would keep the bathroom pretty busy; showers have been found to require as high as 300 gallons per hour when they are in constant use. This gives the maximum possible rates of water consumption in gallons per hour for each kind of fixture:

Fixture	*G.P.H. Max.*
Lavatories	20
Sinks	30
Baths	40
Showers	300

It is necessary to determine what percentage of maximum use is likely to be encountered in the particular building being considered. Shower baths are the most lavish users of hot water, and their use must be most carefully considered. The quantity of water used in a shower in a private bathroom or in a hotel room bath, for instance, would be quite different from that used for a swimming pool shower, because in the first case there would be only one or two users, who would probably not utilize the shower more than four times per day, while in the second case there might be a hundred users. This is why the "percentage of use" must be considered. The "peak" demand must also be taken into account. If the hot water were drawn off at a constant rate all during the day, there would be no object in using a storage type of heater; a continuous heater without storage would do just as well. But the hot water demand fluctuates, and the storage tank builds up a surplus of hot water during periods of low demand to have this available to carry over short periods of exessive demand. One authority says that the actual average hot water consumption for various fixtures located in different buildings is about as shown in this list. In using this schedule it should be noted that the quantities given are for net average use, and that no "percentage of use" factor need be employed.

Gallons per Hour (Average Use)

	Lavatories (Private)	*Lavatories (Public)*	*Baths*	*Showers*	*Sinks*
Residences	2½	x	10	50	5
Apartments	1¾	3½	7	35	3½
Hotels	3½	16	14	70	14
Schools	1¼	x	x	75	2½
Clubs	3	9	12	120	12
Gymnasiums	4	16	16	225	x
Hospitals	2¼	9	9	x	9
Public Baths	5	30	60	x	
Y. M. C. A.'s	3¾	15	30	x	15
Office Bldgs.	1	3	x	x	x
Shops (Indus.)	4½	27	36	270	18
Laundries	5	20	x	x	x

This table will also be an aid in checking up the "percentages of use" to see if the percentage assumed brings the net average use about to that shown in the table. It should be remembered that the ordinary peak load approximates *twice* the average demand.

The Storage Water Heater. This is usually a tank in which heating coils are installed, commonly termed the "multi-tube" type of storage heater (see Fig. 1). It not only serves the purpose of storing up hot water during periods when the full capacity of the heater is not required but also serves to reduce the boiler load for heating the hot water. Assuming an average hot water demand of 1000 gal-

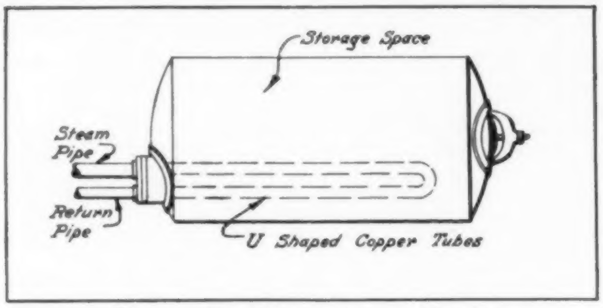


Fig. 1. Hot Water Storage Heater

lons per hour and a peak demand of 2000 gallons per hour, what would be the boiler load without storage and with storage? In the first case, with the water raised 100° Fahr. in temperature and taking a square foot of radiator surface as represented by 240 B.t.u., the boiler capacity used in square feet without storage will be

$$\frac{2000 \times 8\frac{1}{3} \times 100}{240} = 7944 \text{ sq. ft.}$$

but in the second case with storage provided of, say, 1250 gallons, and assuming that this 1250 gallons has been heated at some previous time of low demand, it will be necessary to heat only 1000 gallons per hour, making the boiler load under this condition

$$\frac{1000 \times 8\frac{1}{3} \times 100}{240} = 3472 \text{ sq. ft.}$$

or just half as much. Care must be exercised, however, to make the storage capacity sufficient to last over the *entire period* of peak load, because if it will not do this the reserve water will all be drawn out before the end of the peak period, as will be seen by assuming a water heater with 1250 gallons storage and 1000 gallons per hour heating capacity. If the peak load of 2000 gallons lasts only one hour, this heater will be sufficient, as it heats 1000 gallons and draws another 1000 gallons from its reserve during the first hour of the peak, leaving 250 gallons of hot water in the heater at the end of the first hour. During the second hour the heater will heat another 1000 gallons, but even after using the remaining 250 gallons in storage there will be a shortage of 750 gallons, and the hot water supply will fail almost immediately after the first hour period is completed. In actual practice it has been found impossible to draw out the entire storage without causing a general cooling of all the water in the tank, and for that reason a reserve of about 25 per cent of the total storage must be retained in the heater and *not used.*

Proportioning Heating and Storage. The relative quantities of heating capacity and storage capacity may be said to be represented by the equation:

$$HC + SC = \text{Peak Load} + 25 \text{ per cent of } SC$$

and this is based on the peak load, lasting about an hour as it generally does. HC (heating capacity in g.p.h.) should not be made less than the normal average demand as estimated, and storage capacity (SC) in general is made to equal the difference between normal demand and peak demand for the number of hours necessary to carry over from one period of low demand to another period of low demand. To illustrate, the peak load is generally double the normal load, and, based on this, what

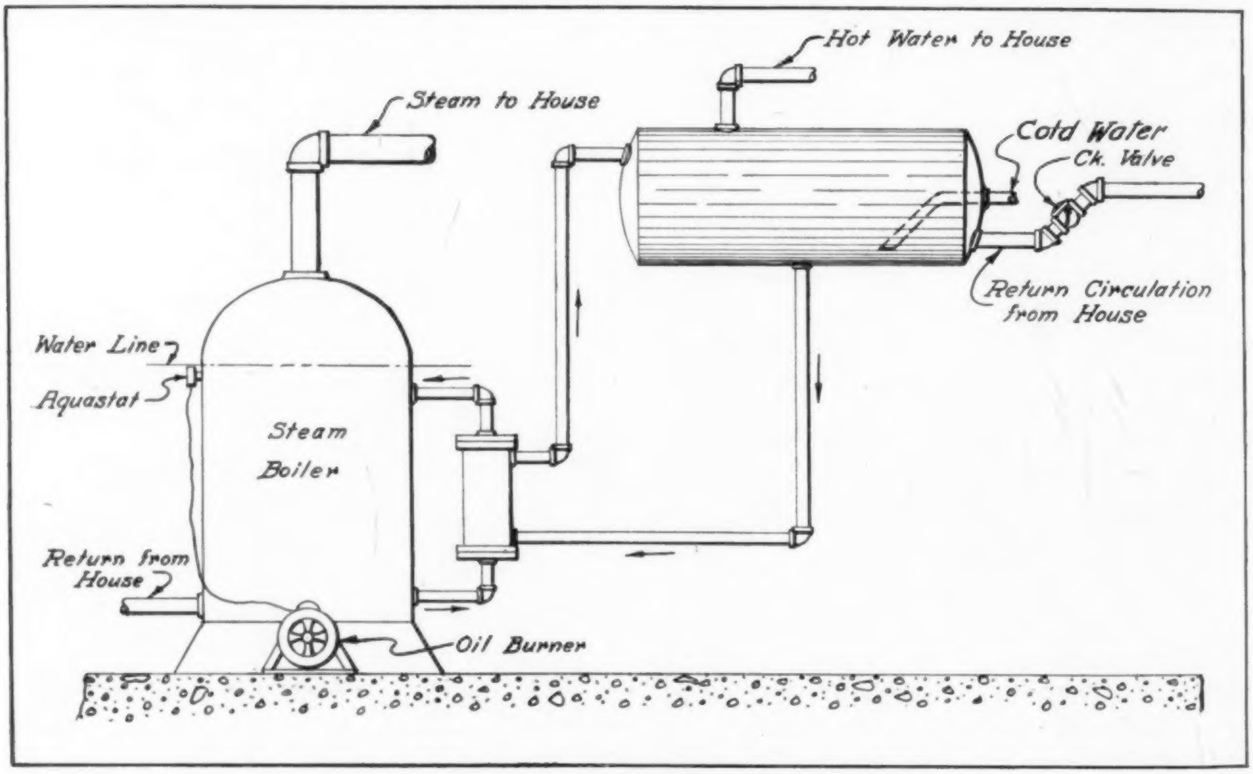


Fig. 2. Boiler and Storage for Domestic Hot Water

would be the combinations permissible for a normal demand of 1000 g.p.h.? If the peak load extends only over one hour, then the heating capacity must be sufficient to carry the normal demand or 1000 g.p.h. Substituting this in the equation, the result is

$$\begin{aligned} 1000 + sc &= 2000 + 25\%\ SC \\ SC - 25\%\ \text{of}\ SC &= 1000 \\ 75\%\quad SC &= 1000 \\ SC &= 1350\ \text{gal. storage.} \end{aligned}$$

Then the heating capacity would be 1000 gallons per hour, and the storage capacity 1350 gallons. Should the peak demand extend over two or three hours, the SC must be doubled or trebled until the storage gets to a point where it is not desirable to further increase the size of the tank, at which time the HC must be increased.

To illustrate, suppose space conditions or some other reason made it undesirable to provide a heater of sufficient size to carry 1350 gallons, and instead only a 500-gallon storage could be obtained. What would be the necessary increase in heating capacity to give the same service? In this instance the SC is fixed at 500 gallons, and substituting this in the equation the result is:

$$\begin{aligned} HC + 500 &= 2000 + 25\%\ \text{of}\ 500 \\ HC &= 2000 + 125 - 500 \\ HC &= 1625\ \text{g.p.h. to be heated.} \end{aligned}$$

Checking this over against the previous proportion, it is found that during the peak hour the first heater with 1000 HC and 1350 SC gives

1000 gal. heated + 1000 gal. from storage equals 2000 gal, for use, while with 1625 heating capacity and 500 storage capacity, and the second heater gives

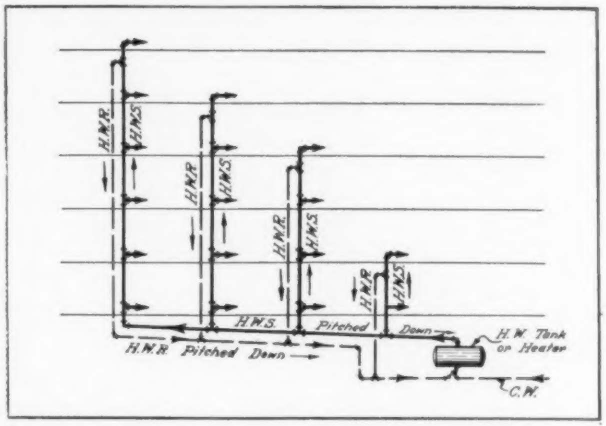


Fig. 4. The Upfeed Hot Water System

1625 gal. heated + 375 from storage equals 2000 gal. for use and in each case 25 per cent of the storage still remains untouched in the heater. The boiler load in the second case is higher during the peak hour than previously, owing to insufficient storage being provided. From this there may be deduced the general principle that if the heating capacity plus three-quarters of the storage capacity equals the peak load, the hot water supply will be sufficient provided that the heating capacity at least equals the normal load, and also provided that the storage is sufficient to carry from one time of low demand until the next.

The Instantaneous Heater. In some cases where the heating demand is a constant and continuous load, the instantaneous water heater is used. The most common use of such a heater is for a swimming pool, where the water is pumped through the heater at a constant rate. In the ordinary building the instantaneous heater is seldom used, since prac-

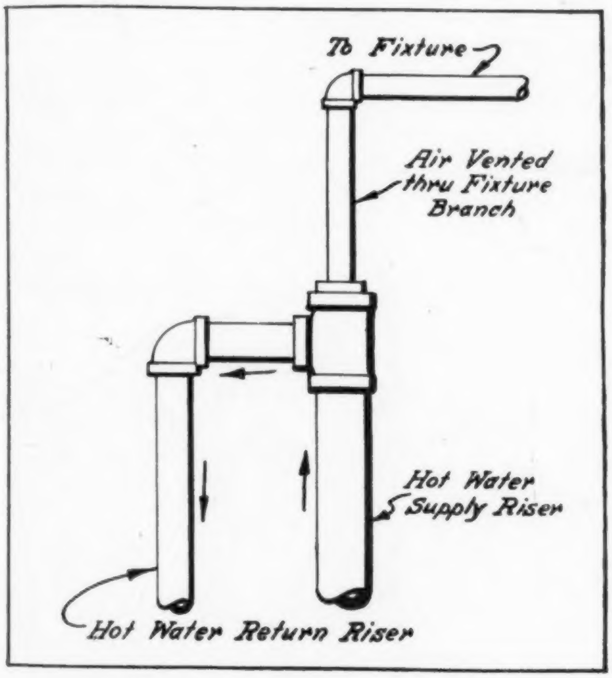


Fig. 3. Connection at Top of Riser

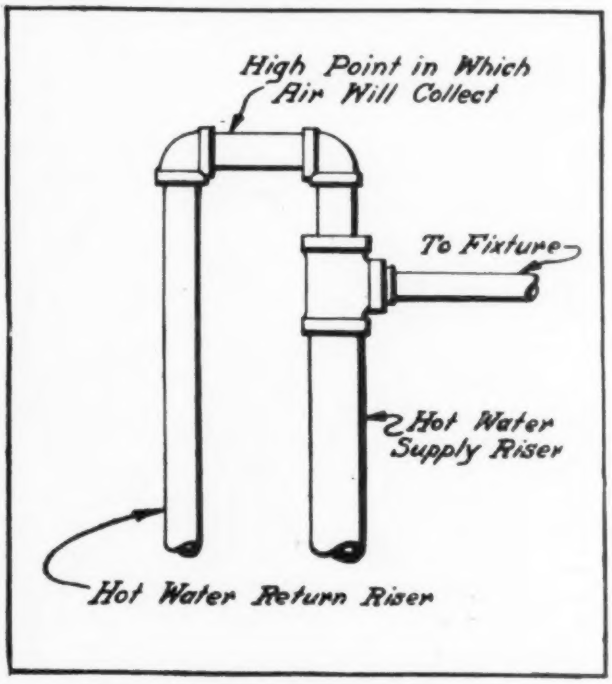


Fig. 5. Wrong Connection at Top of Riser

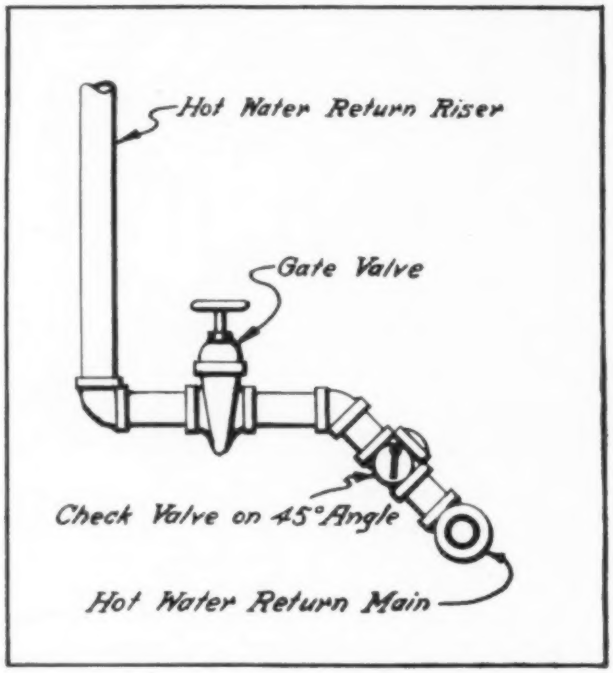


Fig. 6. Gate and Check Valve Connections

tically all building demands for hot water are of a fluctuating character. Small heaters of this type are used to advantage in residences and they are quick-acting; in some cases turning on the hot water faucet starts the heater in action.

Summer Supply. While there is very little difficulty usually in obtaining steam for heating water during the winter, in the summer season when no heat is on in the building it is sometimes a problem to know just what to do in order to care for this condition economically. In a very small building or in a structure where the number of plumbing fixtures is limited, use of an automatic gas water heater of the storage type with thermostatic control is probably the best solution. In larger installations, a small cast iron steam boiler to supply steam to the coils in the tank may be used.

Another method which has come into vogue recently with the advent of oil burners is to use one of the oil-burning boilers during the summer with an indirect heater in which the water for domestic service is heated. This is illustrated in Fig. 2. The oil burner may be controlled by an aquastat placed on the boiler. This turns on the oil burner whenever the temperature of the boiler water goes below 200° Fahr. and shuts it off whenever the boiler water reaches 210° Fahr. In this way no steam is produced, and the boiler water is kept at about 205° Fahr.

The little indirect heater consists of an iron casting or shell which is connected by circulation lines to the boiler, so that the water in the indirect heater is also kept hot. Inside the casing of the indirect heater is a copper coil, which is connected by circulation lines to the storage tank or heater. If the indirect heater is set below the water line of the boiler,—as it should be,—hot water will be obtained as long as the main steam boiler is not allowed to get cold. This arrangement will do equally well for winter use by simpy cutting out the aquastat control on the main steam boiler and switching over to pressure control for the oil burner.

System of Circulation. The arrangement of pipes to carry the hot water to the point where it is to be utilized must next be considered. In every installation of any size, a circulation system should be employed on the basis of convenience to the user as well as of economy of water consumption. The circulation line should be carried within 18 inches of the fixture outlet whenever possible. Hot water circulation is obtained by gravity, except in very rare cases where a pump may be used. Gravity is particularly feasible in tall buildings, whereas a forced circulation by means of pumping is necessary only in low buildings covering a large area, such as one-story industrial shops, etc. Circulation by gravity is obtained in two ways,—first, by what is known as the "upfeed" system, in which supply lines are carried up and return lines are carried back down to the basement, with both supply and return mains located in the basement; and second, by what is known as the "overhead downfeed" system in which all outlets are taken from returns supplied from an overhead main located at the top of the building, the main being fed from a single main supply riser from which there are generally no branches. The bottoms of all the returns are connected and are carried back to the hot water heater, thus completing the circuit.

The Upfeed System. In the upfeed system (Fig. 4) it will be noted that each group of fixtures, since the groups come over one another, is supplied from a special hot water riser, and that in order to have this riser circulate, a branch is taken off the top and carried back to a return main in the basement, this return main usually paralleling the supply main. The hot water outlet from the heater or tank is connected to the supply main, and the return main, after picking up all the circulation lines, is run back and united with the cold water makeup line, both being carried into the hot water tank or heater through a common pipe connection.

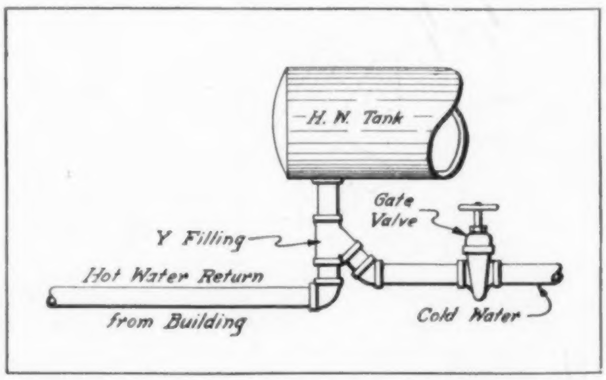


Fig. 7. Good Connection of Cold Water Supply

In "sizing" this supply pipe, the supply risers are sized first, and then the main supply is made large enough to carry the risers, increasing in size as it approaches the heater. In order to secure good results, it is necessary to pitch the supply up continuously from the heater to the last riser in order to prevent air from accumulating and interfering with the circulation. Any horizontal offsets in the riser must also be pitched up in the direction of the flow. At the top of the riser, air relief is usually provided through a fixture connection as illustrated in Fig 3. If the top of the riser is connected into the return circulation line, as shown in Fig. 5, the top of the loop will become filled with air, and circulation will cease. As the tendency to circulate is produced only by the difference in the weights of the columns of water standing in the supply pipe and in the corresponding return pipe, and as this difference in weight is dependent on the small amount of temperature difference, it will be understood how a very small quantity of air pocketed in the line at any point will interfere most seriously with the circulation. The return main is pitched downward in the direction of flow. Owing to usual returns being connected into one main return, it is necessary that each return line (which is usually made of ¾-inch size) be connected into the main return through a check valve, and of course a gate valve. In order that the tongue of the check valve shall offer as little resistance as possible to the circulation, it is desirable to set the check valve on a 45 degree angle so that the tongue will hang vertically, as shown in Fig. 6.

The circulation may be accelerated by connecting the cold water make-up into the hot water return through a "Y" fitting, so as to get the benefit of the injector-like action caused by the inflow of cold water whenever a faucet is opened, as shown in Fig. 7, instead of connecting the cold water line to the tank, where the inflow of cold water does not aid in helping the circulation. Regardless of the size of supply riser, a ¾-inch return circulation line is always sufficient to keep the supply line hot, since the only function of this line is to allow the water in the pipe

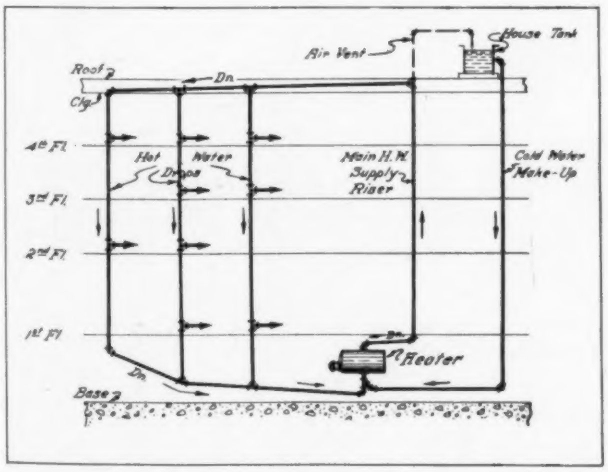


Fig. 8 Overhead Downfeed Circulating System

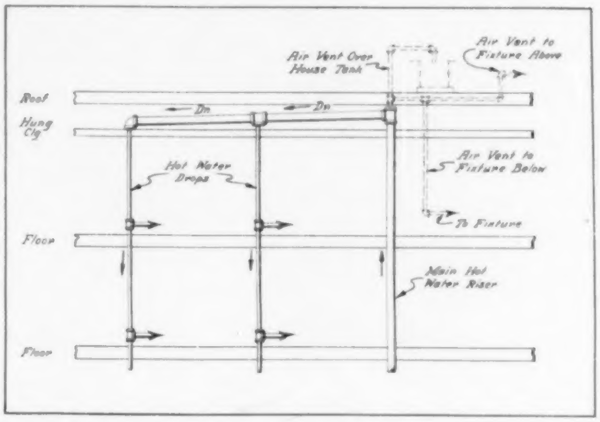


Fig. 9. Three Methods of Venting the Circulating Hot Water System

to flow back to the heater when no water is being used; when water is being drawn from the faucets in any quantity, the line will stay hot; but when no water is drawn off for a long period, the entire contents of the pipe will cool down unless circulation provision is made.

Overhead Downfeed System. In this system of circulation, all the hot water is carried to the top of the building in one main hot water riser and is there distributed horizontally to the various hot water drops which proceed down through the various floors, supplying the fixtures at each level. At the bottom, each drop is connected into a hot water return main which is carried back to the source of supply. Fig. 8 shows a typical circulation system of this character. Better results and less short-circuiting will probably be found in the overhead downfeed scheme, than in the upfeed type. One of the advantages gained in using the overhead downfeed system is that if the hot water tank is located anywhere near the main riser, the heater or tank may be kept comparatively high, owing to the small amount of upward pitch necessary in the short run to the riser; in the upfeed system the supply piping must slope up continuously from the tank or heater to the farthest riser in the building, often encountering low beams, resulting in the heater or tank being considerably depressed in order to maintain the proper pitch on the supply pipe.

Too much emphasis cannot be laid on the importance of pitch in circulating hot water lines; beginning at the tank or heater, the main supply must grade up to the main riser, which runs vertically and usually extends up to the high point on the system from which a small air vent,—of either ¾-inch or 1-inch pipe,—is carried up to, and spilled over into, the house tank. This air vent may also be carried up to a fixture at some higher level, or it may be taken off the top of the riser and then returned to supply some fixture below, the air rising into the top of the bend where it does not interfere with the circulation, and being forced down and out of the fixture outlet when the faucet is opened from time

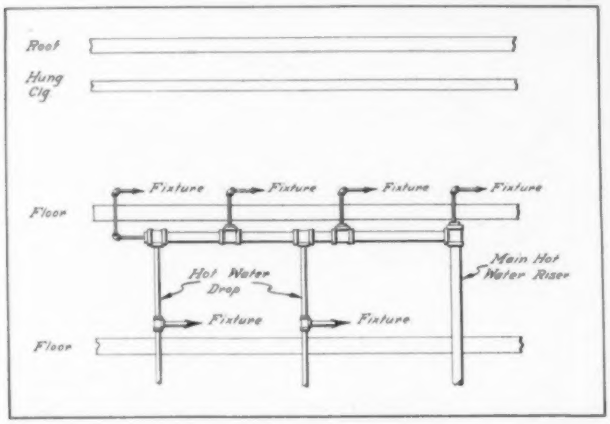


Fig. 10. Venting at Fixtures Above Hot Water Main

to time by the flow of water going to the fixture. These three methods of venting are illustrated in Fig. 9. Where possible, it is better to run the horizontal distribution main on the ceiling or in the furred ceiling under the top floor, and not under the roof as is usually done; this permits economy in piping and covering, a shortening of water travel, and air venting at numerous points; venting occurs wherever a fixture is located on the floor above, as shown in Fig. 10.

Hot Water Pipe Sizing. Hot water lines may be sized on the same basis and by the same methods as used for cold water lines as already explained. The sizes will not run as large as the cold water lines because, (a) all fixtures do not require hot water; (b) there are no connections of over ¾-inch size; (c) the hot water is not used as much as the cold water in most buildings.

In batteries of lavatories, showers, etc., where a large number of fixtures of the same kind are supplied with both hot and cold water, the hot water supply is usually made the same size as the cold water. It should also be remembered that, as all the hot water withdrawn from the system has to be replaced by cold water makeup coming into the heater or tank, the size of this cold water connection will have to be sufficient to supply the total hot water demand at peak load. It frequently works out that the combined area of all the ¾-inch returns when added to the area of the cold water makeup line will exceed the hot water supply pipe area; but the circulation proceeds when no makeup is entering the system, and consequently both lines do not necessarily deliver at their full capacity at the same time.

Hot Water for Showers. Shower baths require particular protection against excessive temperature water in all cases, but particularly when arranged in batteries for the use of children, as occurs in high schools, swimming pools, and some institutions. If the shower installation is sufficiently large to justify a separate hot water heater thermostatically controlled, so that the maximum temperature of water delivered to the hot water side of the showers does not exceed 100° to 110° Fahr., this is the best answer. Where this seems unduly expensive or structurally unwise, hot water may be taken from the central system and run through a thermostatic mixer where a certain amount of cold water is automatically added, the cooled water entering a "mixed" water line which is used for the hot side of the showers. Further protection may be obtained by inserting a thermostat in the mixed water line with a stop valve so that all mixed water is shut off as soon as the mixer fails to work properly and the temperature exceeds the desirable safe limit. This is illustrated in Fig. 11. In single showers, the use of the thermostatic mixing valve is efficient if a "mixed" water line cannot be obtained for the hot side. In kitchens, laundries, and industrial processes requiring special high-temperature water, it is advisable to use a separate heater or,—if high-pressure steam is available,—to use a thermostatic mixer specially designed for this purpose.

All hot water lines, both supply and return, should be covered with insulation, and the radiation from circulating lines should be allowed for in determining the heating load of the hot water heater.

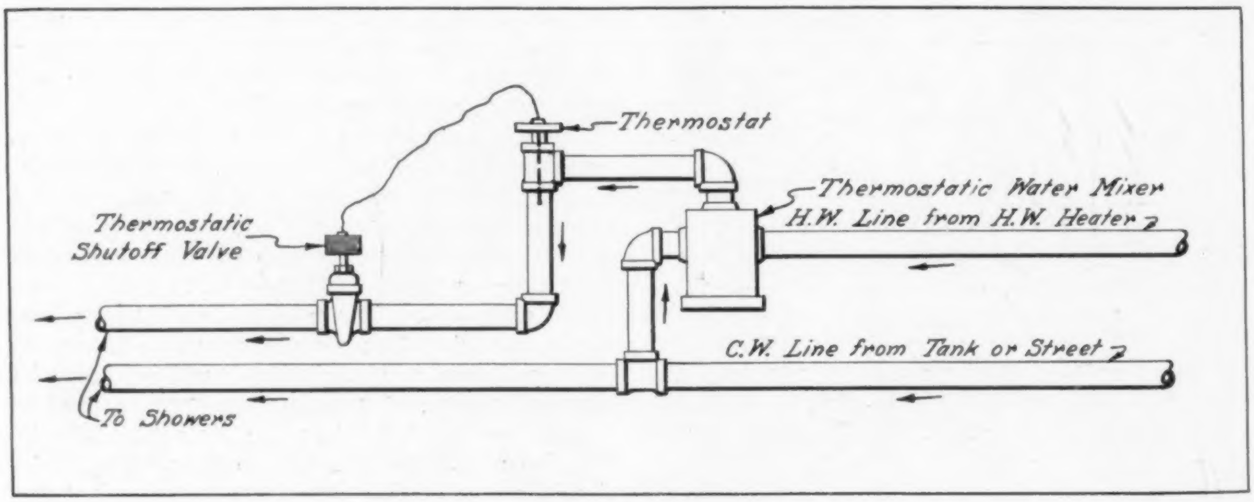


Fig. 12. Thermostatic Shutoff for Shower Supply

HOUSES OR STAGE SCENERY?

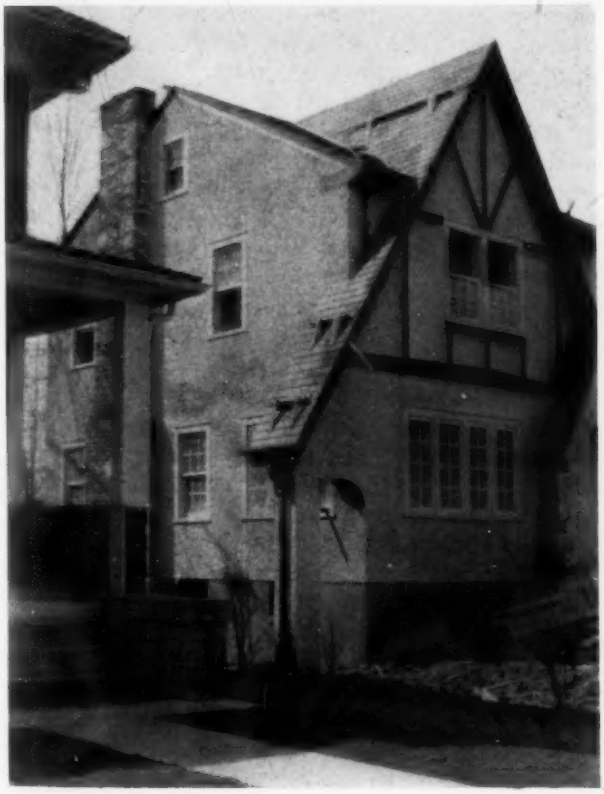
BY

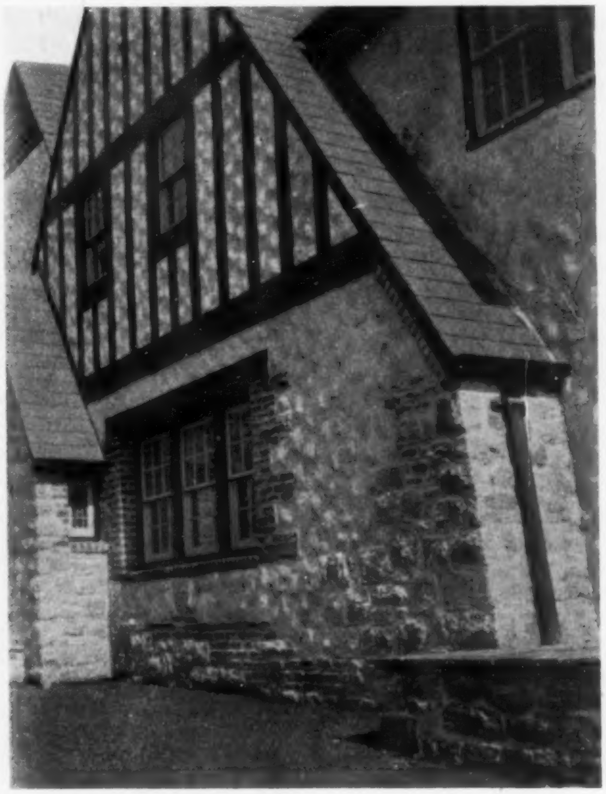
H. VANDERVOORT WALSH

WE are going through a very strange period in our domestic architecture. It is a make-believe era. We seem to want to live in dream houses, in quaint, old fashioned houses, in fantastic castles. In the working parts of our homes we demand practicality, but we try to clothe it with a veil of unreality. Perhaps life, with all of its grind today, is too wearing on our nerves, and we think of home as a retreat from the cold, bitter facts of our existence. Whatever be the cause of this feeling, the evidence is growing on every hand that people are demanding houses that reflect, not our own age, but some other past age. But this desire to live in a house that looks two, three, or four centuries old seems to be stimulated by the great number of magazines which publish soft and appealing illustrations of picturesque homes. Houses that are unreal, that are built like stage scenery, look very well in illustrations, for pictures are, after all, quite unreal. I believe these alluring views have helped to lead people on to imagining their homes as places of escape from life. They have stimulated them to want mediæval houses, for what dwellings are so romantic, so picturesque, so like the houses we read about?

American architects, sensing this some 20 years ago, were trying to design houses as they were built in the middle ages. In their trips through Europe, they were carried away by the picturesque quality of the very old English cottages and manors, and by the half-timber buildings in the towns, the houses of Normandy, and the quaint peasant homes along the French country roads. The urge to reproduce them was tremendous, and so they tried it, but failed. Their houses were hard and unromantic. The timbers which they put into them, in imitation of half-timber construction, were obviously sawed and planed planks of wood, veneered onto the faces of the walls. The stucco between the timbers was smooth and finished, like a piece of good, mechanical plaster work. The roofs were true, for rafters were cut straight by mechanical saws. The shingles or the slates were square and shiny, with perfect machine cutting. The whole appearance of their houses was as far away from that of the old, mediæval dwellings, which they had seen, as America is from Europe. Instead of being appealing, like a castle in a dream, they were cruel reminders of the hardness of a mechanical age!

But man is resourceful in his search for the things of his dreams. Some clever architects discovered that with a little trickery they could remove this hardness of the machine. Instead of using straight sawed planks, veneered onto the exterior to imitate the half-timber construction, these planks were subjected to a hacking process. The carpenter was instructed to rough up on the surface with his adz. The straight edges of the planks





Stage Scenery or Architecture?

were cut to wavy profiles, such as a solid timber would have had had it been adzed to shape from a tree. At a distance, when these doctored boards are nailed in place, they look like the real old thing; they seem to be heavy timbers, cut down from the nearby woods and set in place after having been shaped by axe and adz. The stucco placed between them (only about an inch thick and on metal lath!) was also subjected to a roughing process to make it look like solid, hand-laid masonry, such as was stuffed between the large timbers of the frame. It was gobbed on with a careless trowel and roughed up with a scratching stick and bespattered with the colors of old age. The illusion was perfect,—for those who knew a little about half-timber houses and had traveled in England. Atmosphere was acquired by a few dollars judiciously spent in getting good mechanics to work in a slovenly manner.

Now the architect had turned the trick. The half-timber house took on a beauty, under his direction, that was in harmony with the style. A touch here and there of a little stain; a broken stone or tile placed carefully; old vines and shrubbery cleverly located at critical points, finished the picture. His intellectual and moneyed client who had traveled and knew the periods of the various styles of architecture, applauded. A scholar and an artist, this architect must be! Such a romantic place to live! Such a relief from the world of mechanical things! So picturesque, so quaint! It was a triumph for the profession. Manufacturers were quick to catch the idea, and supplied the architects with the materials.

In ten years our domestic architecture, of the better class, took on a dignity and charm that Europe needed hundreds of years to acquire. Photographs of ancient masonry and brickwork were given to American-Irish masons, and they were told to build walls as nearly like them as possible. These good hearted men tried, in spite of the ridicule of their fellow laborers. Measured drawings of ancient buildings multiplied in all the periodicals. Studies with camera and pencil were made of the textures on old materials, so that the hard, machine-made thing could be hacked, clubbed, cut, cracked and smeared into a thing of beauty. And now the public has taken the doctrine of faking seriously. It has learned to love the spirit of the antique. It pretends to hate anything that is made by machine. If it cannot have a real hand-made product, it must look as though it were hand-made. The speculative builder has sensed the taste, and met the demand.

Never has there been such a conglomeration of construction materials as we are getting in the majority of our houses today. Riots of color in the roughest of stucco; plaster walls smeared with "plastic paint," a material never known before the age of American faking, are seen multiplying by the thousands. Oak timbered ceilings are made out of plaster or asbestos sheets in imitation of famous oak ceilings of old England, perfect reproductions for the untrained eye and almost deceptive to the trained; imitation wrought iron strap hinges on front doors, hinges which end at the edge of the door, the door itself swinging on common butts; old, battered lanterns, lighted by modern electric lights; yellow pine, pounded with a hammer and stained to look like ancient oak,—the fakes are innumerable and growing in number every day. Our houses are wild with "picturesque" things, stunts, curves and gable ends that swing down to the ground with no houses behind them. Everywhere we see houses of the old English farmhouse type, erected by speculators from the plans of "architects" who sell the designs, relinquishing all further interest in the development of the schemes. Many young architects turn these plans out on the side, as pot-boilers, getting from $50 to $75 per set. When such houses are turned over to the mercy of the builder, he develops them with his own choice of building materials that give the roughest kind of textures. He thinks he is simulating the work of the best architects, but this matter of using machine-made materials in imitation of the hand-wrought product requires the dexterity of a prestidigitator and the skill of the scenic painter to simulate reality. Although the design may have much in its favor,—suitable plan, and pleasant proportions of parts, etc.,—when this doctoring of materials is carried on by the uncouth builder, the results are monstrosities.

The sins of the professional architect have trebled themselves. His delicate art of retouching materials has grown to be a commercial necessity. Our magazines are filled with colorful advertisements, showing roof tiles, bricks, stucco, plastic paints, floor tiles, plaster ornaments, wrought iron hardware, and many other materials which are sold in a faked condition. Machines have been made which will stamp the touch of the craftsman all over the material. Each wrought iron object can have the same marks of the hammer of the craftsman in the same places, reproduced a thousand times. Wooden beams for the ceiling can be run through machines with revolving knives that will indent the surfaces like the cuts of a hand-swung adz,—only the machines will chip regularly every 2 inches, producing a marcel-wave texture. Plaster surface can be given the appearance of ancient work by covering it with plastic paints, and smearing it.

All this effort, all this added expense, is the result of the leadership of architects who have insisted on designing their houses in those styles which were developed during the days of no machines and when craftsmen worked with their hands. They have set the fashion, and the little fellows have copied, and the manufacturers of building materials have redesigned their machines to produce the kind of product that the fashion demands. Now is it not about time that architects of good taste recognized this dishonest use of building materials? Is it not time to begin building without disguise of materials produced by machines? Ought we not frown on use of all those styles of architecture which depend for effect on stage scenery, which imitates the work of the hand craftsman and the patina of age.

BUILDING FUTURE REAL ESTATE VALUES INTO HOMES

BY

TYLER STEWART ROGERS

UNDER the pressure of routine problems of design and specifications, of getting commissions and of executing them, there is a perfectly natural tendency on the part of some architects to neglect some of the fundamental problems which underlie all successful architectural practice. Particularly this is true of the economic aspects of building operations, which frequently become submerged under considerations of design features, clients' demands and ideas, and matters of expediency. The basic value of an architect's service lies almost wholly in the fact that it should produce a recognizable value, indeed a commercial or market value, greater than its cost, and consequently greater than of the building the owner could achieve without the architect's help. This article is concerned with the fundamental importance of constantly creating future real estate values in the designing and construction of homes.

Such neglect of this important matter as may be evidenced in the typical modern home arises in a very natural way. Today there is almost unprecedented interest in architectural styles, and home builders are vying one with another to create something particularly fine (or unique) in every style from the mediæval to the extreme modern. The vagaries of style popularity are dominating all architectural problems. The danger lies in the inpermanence of the popularity of styles, especially of those of the more eccentric and hybrid character,—and impermanence is a luxury few can afford in the development of a home. The vast majority of residences designed by architects are built primarily for occupancy by the clients. Naturally, the latter desire their homes to be designed to meet their particular requirements as to plan, accommodations and equipment, and to accord with their preferences as to style. In establishing his basic requirements, the owner is influenced by the size and composition of his family, his social habits, his hobbies, furnishings, taste, and his conceptions of luxury. Only rarely is he concerned with that future date when the property may change hands. He is building for himself, and "he wants what he wants."

Nevertheless, there is always the economic aspect to consider. Our present mode of living is in itself too impermanent to warrant the thought that an individual home is being built for future generations of the same family. Changes in family requirements for accommodations, a removal of business to another locality, an increase or decrease in the family income, death or the stork, or changes in the neighboring environment may result in forcing the house on the market, contrary to all previous intentions. Very often there is the opportunity to sell at a profit through a substantial appreciation in land values. The average house, built for occupancy, finds its way into the realty market, not once, but usually several times in a generation. At the same time it represents a major investment on the part of the client; an investment, in fact, that usually represents a substantial part of the owner's total estate. To be sure, this works out in an inverse ratio to the size and cost of the dwelling, for those who can build the more costly homes usually invest a smaller percentage of their wealth in the enterprise than those who seek more modest accommodations. It is of the utmost practical importance to conserve the investment and to surround it with every possible protection against depreciation and loss.

From an investment point of view, the minimum requirement is that the property at all times shall have a value equal to the original investment after deducting a fair charge for rent during the period of ownership and occupancy. It is not necessary to anticipate a complete recovery of the initial cost, for a building is not like a bond having a fixed recoverable value; depreciation, obsolescence, and maintenance charges must be anticipated. Only the land normally represents a true investment, having supposedly stable and undiminishing value. If the land enjoys an increment during the period of ownership, that increment represents a speculative return, and strictly should not be considered as an offset to undue depreciation in the value of the dwelling.

It may not seem difficult to so design and construct a dwelling as to meet this minimum economic requirement. There are many influences working at variance to this end, however, not the least of which is the owner's attitude toward his project. Furthermore, the last five years,—in fact the last 15 years,—have seen such inflation of values in real estate that many home owners and even bankers have come to expect at least a modicum of profit from their home building investments in the event of sales, and the economic standard just outlined represents less than a satisfactory outcome of their enterprises. In practice the architect has failed in his work if he has not injected into the project more than average stability in real estate values, barring only those projects in which the owners can afford to neglect entirely the economic phases, and indulge in the pure luxury of building what they want without respect to what other people will pay for it later on. The real test of the architect's product economically is the auction block. Here real estate values are established and measured. When two dwellings of equal size and accommodations reach the auction block together, after discounting land values, the difference in the prices they bring is a real dollar measure of the architect's skill and its value. The difference in price is then due either to matters of design or of construction, or both, and these matters are dis-

tinctly within the province and largely within the control of the architect.

There are four factors that influence the market value of a home. They are (1) obsolescence of style; (2) obsolescence of plan; (3) structural depreciation; and (4) neighborhood depreciation or appreciation. Expressed more positively, and with reference to new properties, the factors may be defined as, popularity of style and plan; quality of construction; and desirability of location and site.

Architectural Style; Its Market Value. Style popularity, or the "vogue" of architectural styles, is probably the most important single factor endangering stability in the market values of homes. Recently we have all seen the rise and fall in popularity of early Colonial, English, French, Norman, Italian, Spanish and other more or less readily defined period styles, and today we are watching the development of the "Modernist" style. The vogue changes almost as rapidly as styles in dress and motor cars. Travel, motion pictures, and even the radio, and more particularly the popular home building magazines themselves, have developed a surprising breadth of taste, and have largely wiped away the former regional preferences for one style. There is no longer an adherence to a "native" style; probably there never will be any unified, predominant style. The changing vogues are psychological in their origin; they are likely to run in waves or cycles and can, to all practical purposes, be neglected.

The permanent values in architecture are appropriateness and excellence of design. Considering design features only, those houses which possess the greatest excellence of design for their respective types command the highest prices when on the auction block. Popular appreciation of good design is not as insignificant as many students are led to believe. Appropriateness of design is a factor, for a house unsuited to its locality and environment is discounted in value. This means that the architect, seeking to establish permanent real estate values in the dwellings he designs, must avoid those eccentricities of design which are the outgrowth of either the clients' lack of perception of design values or the architect's ambition to do something unusual,—which frequently means something bizarre.

The owner is very frequently at fault in preventing the architect from doing his best work by insisting upon features of plan arrangement, ceiling heights, and other details which are at variance with good proportion and balance; or by insisting upon the use of materials inappropriate to the design that has been adopted; or more frequently by insisting on subsequent changes in the drawings or specifications to reduce cost, which often ruin the very features upon which the architect places the greatest reliance for achieving a successful and excellent structure. There is plenty of evidence in every suburb to support this statement. Speculative builders endeavor to emulate the more successful designs developed by skilled architects, but in doing so they lack the appreciation of details and refinements which distinguish the work of the real artist. Their products are frequently horrible examples of poor design, even when their inspiration may be drawn from excellent buildings. Those dwellings which retain their values over the longest period of years are those which are conservatively designed. Eccentricities are usually of very impermanent value. They may have vogue for the moment, but as public taste improves and as years go by, the oddities are exaggerated and detract from the value of the property. If one pauses to examine the work of those architectural offices which have achieved the most enviable prestige in the domestic field, one cannot help but note that conservatism is the keynote of their designs. They are rarely guilty of the fault of wasting time or effort endeavoring to achieve something wholly different or unique. Their products almost invariably have high and enduring market value.

Market Value of Intelligent Planning. Planning is extremely important in maintaining market values, and here again the owner's preconceived idea is frequently the most difficult factor to contend with in developing a plan for a house which will be salable later on. In plan the owner is most likely to express his individual requirements to the greatest degree, for while he may be willing to leave matters of style and decoration in the more expert hands of an architect, he feels himself competent to lay out a plan which will meet his own family requirements and personal ideas of convenience and luxury. The usual result is a plan that will fit only his own needs and which will be poorly adapted to the requirements of another owner. This unorthodox type of planning endangers realty values in various ways. If it results in an extended plan with many projections and irregularities, it increases the cost of construction without proportionately increasing the accommodations or the desirability of the structure as a whole. It may be poorly adapted to the more nearly normal requirements of a typical buyer. The social habits and housekeeping habits of the original owner may also be at variance with normal customs, resulting in a plan that is inconvenient and difficult to maintain. It is the architect's business to keep the owner's requirements within the bounds of reason in order that the house may be more truly adapted to average requirements, lest the market value ultimately prove to be far below the initial cost. He should bring these considerations to the attention of his client.

Market Value of Good Construction. Permanence in realty values obviously depends upon sound construction. An attempt to economize on structural details through the use of inferior materials nd poor workmanship is shortsighted "economy" of the worst type. Equally dangerous is the adoption of untried materials, either for the sake of economy or through curiosity to see how they work out. Many of the new products are excellent, but for every one that is good there are several which are merely

cheap substitutes of unproved merit. Furthermore, a substantial proportion of the new products are developed to satisfy stylistic trends. For the time being these products may be very much in vogue and yet ultimately have no permanent value, especially when their use has been overdone. An example in point is the present use of plastic paints and other similar products used to achieve special decorative plaster effects. The materials that have been developed for this purpose are highly successful when properly used. Some of them are necessarily better than others, but all of them are susceptible to abuse. There has been a notable vogue for the rough plaster effects characteristic of the "Mediterranean" styles of architecture and some of the more primitive English and early Colonial dwellings. In the hands of a skilled architect these materials may be properly employed with the same restraint that is exercised in the use of many other decorative finishes, but the danger lies in their use under inappropriate circumstances and in exaggerating the effects beyond the limits of good taste. Actually, in the hands of speculative builders and those who have not appreciated the design limitations of these products, they have been so thoroughly abused that they are rapidly becoming in danger of losing their popularity. If this situation develops further, those dwellings which have been finished in this manner may lose something of their market value because such wall finishes are very difficult to remove. Only where they have been used with due consideration to their decorative precedents are they likely to contribute to the stability in market value of the dwellings in which they are employed.

A careful balance must be maintained between that ultra-conservative attitude which uses only tried and proved materials of a generation ago, and the ultra-progressive attitude which adopts without question and without proof the new products which daily enter the building market. Ten years hence a house which lacks those structural features which today are new but which possess such sound merit as to result in subsequent universal employment, will be out of date and subject to loss through obsolescence as compared with another building of equal age in which such materials have been properly employed. A half-dozen materials of this nature might be suggested, including insulation materials, the value of which has already been established beyond question; the use of tiles in bathrooms (preferably with the introduction of some color); and the use of modern heating systems selected for their efficiency and economy of operation and their susceptibility to practically automatic control.

Stabilizing Neighborhood Values. The fourth factor which influences future realty values,—the appreciation or depreciation in neighborhood land values,—may appear to be beyond the control of the architect. To a large extent this is true, except insofar as the architect may advise his client with respect to the selection of the site and contribute to the adoption of sound zoning regulations and other protective methods designed to stabilize realty values and to protect neighborhoods from an undue change in character. Nevertheless, the architect has one important responsibility in this respect, for it is part of his problem to design his client's house in a style and character which is well adapted to the chosen neighborhood and which will fit gracefully into the environment. The introduction of a Spanish type house in a colony of well designed Colonial structures may not only detract from the neighborhood's values but may be so out of place as to immediately penalize the owner, should he be seeking a loan or undertake to sell his property shortly after completion. Likewise, the development of a $50,000 house sandwiched between $20,000 structures endangers the client's investment far more than it enhances the value of the neighboring properties. Preventing such mistakes is definitely part of the architect's responsibility to his client, and in disseminating sound advice on these points the architect is also fulfilling his implied responsibilities to the community.

Realty Values and the Banker. We previously made the statement that the auction block supplies the crucial test of the architect's product, but there is another and more immediate test which frequently measures the value of the architect's services to his client. In the event a new home is to be financed partly on funds secured through a mortgage loan, the architect's drawings and specifications are subjected to the scrutiny of expert appraisers employed by the lender, appraisers whose function is to establish the market value of the completed property. Mortgage loans are not based only upon the cost of a house. The lender is concerned only with the protection which exists above the amount of the mortgage he grants in the event the property is forced upon the market through foreclosure or otherwise; in other words, the auction block value of the property is the only value that interests the lender. Under this critical test eccentricities of design and plan are measured as extravagances which have no value as bases for a mortgage loan. The extra cost of features not in accordance with popular taste and demand is immediately discounted. The appraisers may go further and consider eccentricities as injuring the market value of the property, thus lessening the size of a loan which may be obtained. The same consideration applies to luxurious features, details such as expensive paneling, decorations, etc.

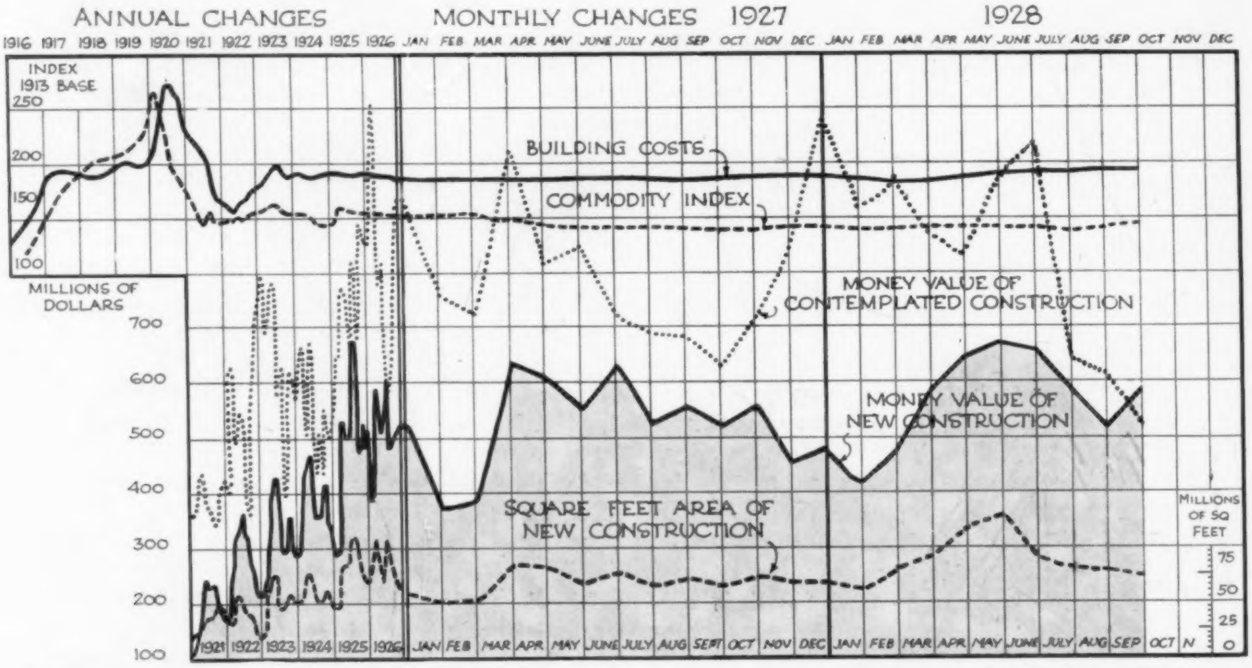
The best general guide to creating future real estate values in homes is to maintain a sane balance in design, plan, and construction so that a due proportion of the investment is devoted to structural details and a reasonable proportion to the matters of plan arrangement, decorative treatment, and finish. If the owner insists upon an unorthodox structure, the architect at least should call his attention to the probability that the ultimate market value of the property may be less than the owner anticipates.

THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

THIS year has been notable for the number of construction records broken month by month and for the cumulative totals during the first eight months of the year; and September construction continues this intensive activity. In the territory east of the Rocky Mountains construction contracts reached a total of $587,674,000, according to the figures of the F. W. Dodge Corporation. The area covered includes the 37 eastern states and represents approximately 91 per cent of the total construction in the United States. This construction total was 13 per cent ahead of the total for September, 1927, and 14 per cent ahead of the figures for August of this year. As a consequence of this activity, the cumulative total for the year represents a 7 per cent increase over the corresponding period of 1927. In analyzing these figures it must be noted that $86,000,000 is accounted for by five extraordinary construction contracts in the industrial and utility fields. A $40,000,000 power development in New Hampshire; a $10,000,000 rayon plant in South Carolina; a $9,000,000 coke plant in Pennsylvania; a $5,000,000 steel mill in Ohio; and subway contracts in New York of $22,000,000 play a part. The eastern states established new records, and the central and western states showed declines as compared with building activity during the preceding month and during the corresponding month of last year.

The outstanding items in the September building record include: $202,806,900, or 35 per cent of the total, for residential construction; $119,013,600, or 20 per cent, for public works and public utilities; $114,780,300, or 19 per cent, for industrial buildings; $60,068,000, or 10 per cent, for commercial buildings; $38,800,500, or 7 per cent for educational buildings; and $23,845,700, or 4 per cent, for hospitals and institutions. New projects contemplated and reported in the 37 eastern states amounted to $522,655,600, which is a decrease of 15 per cent from the total reported in August, 1928, and a drop of 17 per cent from the amount reported for September of last year. This decline in new projects, taken into consideration with a similar sharp decline during the preceding month, may be partly accounted for by prevailing high interest rates and a restriction in the money available for construction purposes. An analysis of the regional figures shows several trends which must be considered in the light of the five large contracts just noted. New York state and northern New Jersey showed an increase in September contracts of 22 per cent as compared with the preceding month, and 46 per cent as compared with September, 1927.



THESE various important factors of change in the building situation are recorded in the chart given here: (1) *Building Costs.* This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) *Commodity Index.* Index figure determined by the United States Department of Labor. (3) *Money Value of Contemplated Construction.* Value of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corp., and *Engineering News-Record.* (4) *Money Value of New Construction.* Total valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) *Square Foot Area of New Construction.* The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.